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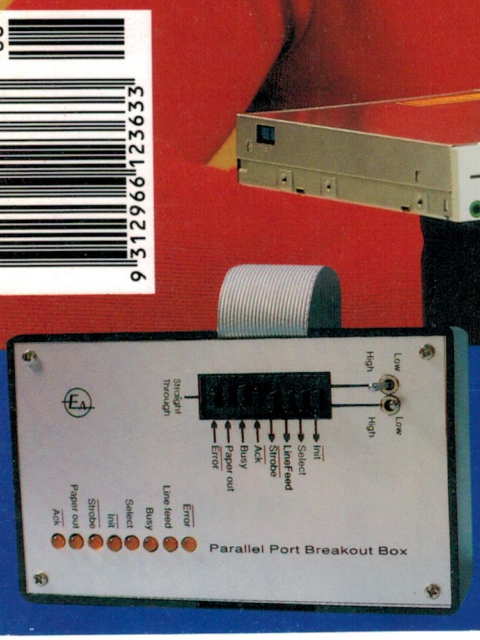
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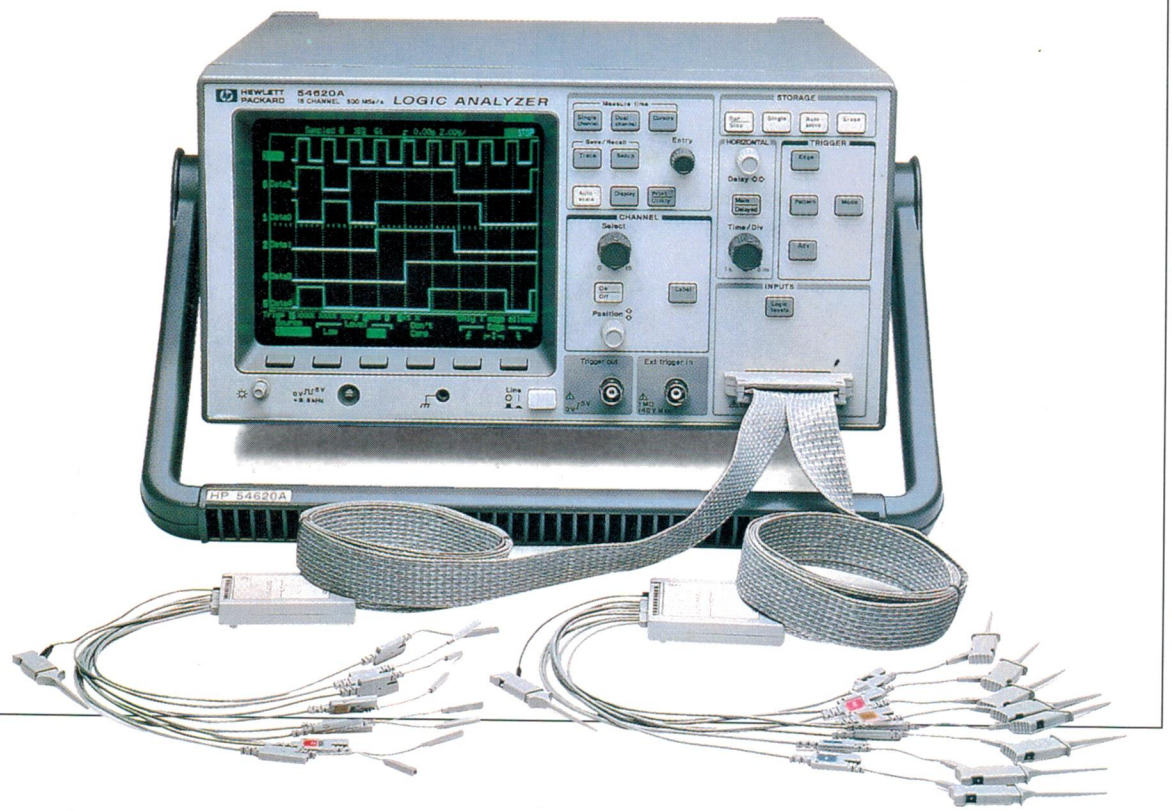
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Volume 57, No.8
August 1995

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Rendezvous in space



NASA's STS-63 shuttle mission earlier this year is being hailed as the beginning of a new era in international space cooperation. Kate Doolan explains in her story starting on page 26.

'And now, live from China'



On page 14, Bryce Templeton continues his 'behind the scenes' story of NBC's historic TV broadcast from China. This time he describes the preparations in Beijing and Shanghai...

On the cover

In our main picture, Elizabeth Luford demonstrates the tiny size of Sony's impressive new rewritable MD Data Disc, each of which can store up to 140MB of data (see our review, starting on page 10). The inset shot shows Graham Cattley's new parallel port breakout box project — see page 68. (Photography by Peter Beattie.)

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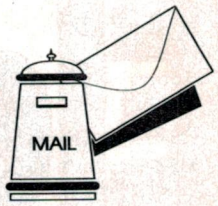
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LETTERS TO THE EDITOR



Charging dry cells

With reference to the article in the May issue concerning Greencell Battery Chargers, by Peter Phillips, and to the summary in particular, I enclose a photograph of a Mallory Rechargeable Alkaline Cell which we used to sell some 15 to 18 years ago.



They were available in AA, C, and I think D size, and from memory cost about 50% more than standard alkaline cells. The interesting thing is that the C size was rated at 1.5V at 1AH and could be recharged in standard NiCad chargers.

I have not been in touch with PR Mallory Co since and do not know if these units are still available, but doubt it.

Looks as if history will repeat itself yet again!

George D.T. Young,
Phillip Photographics,
Canberra, ACT.

Razorblade radio

I look forward to and enjoy reading your magazine each month. I have tried the new BBS service and must congratulate you on its inception. It is handy to have an online service to track down articles and circuits from 'years-gone-by'.

I would like to suggest a topic for your magazine (that one of your wartime contributors could write) that I am sure many of today's 'digital hobbyists' (like myself) would be interested in. A few months ago, I visited the historical museum in Gulgong, NSW. In the displays from World War II was a little radio receiver constructed with a razor blade. How was such a thing built? What parts were used? What other wartime electronic devices were secretly fashioned in POW camps? I am sure some of your readers have diagrams or know how these devices were constructed. I think that it would be very educational to have an article on how these devices operated and how similar devices can be built by hobbyists today. It would be a shame if the knowledge of these devices passed into oblivion.

Finally, a question on converting Australian 240 volt appliances to Canadian 120V. I will be moving back to Canada late next year and would like to take my TV (a Panasonic PAL/NTSC syste), an Akai VCR (PAL receiver/playback, NTSC playback), Pioneer mini-stereo system and Panasonic microwave back with me.

With all of these, can I merely exchange the transformer for the Canadian 120V system? Or is there a problem with the frequency (Hz differences?). Should I contact the manufacturers in Australia (re: Obtaining the transfers?), or wait until I get to Canada? With the Akai VCR, can that be changed to receive NTSC signals easily and cheaply (i.e., plug in a new receiver chip?), or would I be better off to sell the machine before I move back and buy a new one in Canada?

Thank you and keep up the great articles in your magazine.

William Donaldson,
Cremorne, NSW.

Comment: Many modern appliances have power supplies which can be changed fairly easily from 240V to 120V, William, and also from 50Hz to 60Hz as used in Canada. You may be advised to contact the manufacturers, though, to make sure. Your VCR may not need modification, but it's wise to check.

Long time reader

I regret to say that I will no longer be able to renew my subscription to your *Electronics Australia* magazine. I am now in a retirement home and their fees total almost all my pension, plus a generous rental assistance provided by the Department of Social Security.

A lending library calls every week and I hope to get copies of *EA* to read from them.

I started off with *Wireless Weekly* as a teenager about 1931 and followed through all these years. During that time, I have become a radio serviceman, broadcast station technician and then a TV technician from 1960 to retirement in 1977.

I built up many of your projects and the information I got from your pages was a great help to me in my work. The change from valves to transistors shook me at first, but transistor servicing became child's play in the end.

I have seen many great changes in

electrical and atomic theory through my life but it has all been a lot of fun.

I wish for continued success in the life of *EA* and I hope I can keep on taking an interest in your doings.

Alex G. Dorwaard,
Northview via Mackay, Qld.

Comment: Many thanks for your support over all those years, Alex, and we're glad you found the magazine of interest and value. All the best for the future.

Enthusiastic mum

How many letters do you get from females? I know how many you (don't) publish as I am one of the many mothers/wives/sisters/daughters who scan the pages of *EA* each month.

My grandfather was an electrician — his first jobs were converting houses from gas! My brother graduated as an electronics engineer, my husband is an enthusiastic amateur, one son now runs his own technical electronics business and another is completing an engineering/computing degree.

And where do I fit in? I was the guinea pig grasping handles that gave little shocks, and I road tested home made crystal sets and walkie talkies as a child. As a wife I have stood in all sorts of places answering 'better' or 'worse' as aerials were adjusted and connections made.

The mother bit was the hardest, as a son who obviously had wires instead of veins in his body experimented. What a shame the electronic alarm which was set to catch Father Christmas failed to awaken the sleeper (twice)!

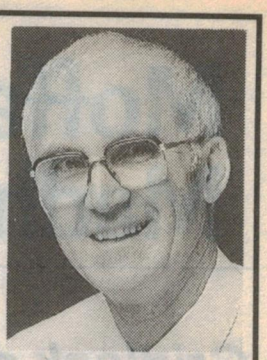
Often I have been sent all over town to track down that elusive component. Trying to look intelligent, repeating word for word the exact lines I memorised only to be asked a question for which I had no answer.

I'm afraid to say that being surrounded with such expertise I have never tried to wire a three pin plug and don't even know how to operate the VCR! I love using computers, but have no idea what goes on inside. Despite this, I find it takes me a couple of hours to scan *EA* as there are always a couple of articles that I find interesting. And guess who, for the past 35 years, has paid for *EA* (or *Radio & Hobbies* in the past) — yours truly.

(Mrs) Rae Moore,
Neerim East, Vic.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



How far we've come in measurement and data storage

One of the things that attracted me into the electronics industry, quite a few years ago now, was that there always seemed to be exciting new developments taking place — new technologies evolving, new devices to learn about and put to use, and so on. There seemed little likelihood of ever being bored; and this has certainly turned out to be the case.

Of course this 'constantly evolving' nature of electronics is even more true nowadays than it was back then. Nowadays the developments tend to come so thick and fast, that it's almost impossible for anyone to even keep up, let alone become bored. If anything, there's the opposite danger of becoming blase, and of simply taking each new development for granted...

I was really reminded of this danger by two of the developments discussed in this month's issue. One is Sony's new Mini Disc Data Drive, which forms the subject of Louis Challis' review; the other is the new Fluke 5500A Calibrator, which I reviewed myself.

You really have to hold the MD Data Drive and one of the MD cartridges in your hand, I think, to grasp the significance of this achievement. It seems no time at all since many of us were cheerfully using a PC with a couple of 360KB floppy disks — and now you can slip a number of Mini Discs, each holding no less than 140MB of rewritable memory, into a single shirt pocket (an ordinary one, too).

I dare say that in another few years, we'll have portable storage media of much larger capacity again, and no doubt in an even smaller package — perhaps with no moving parts at all. But for the present, the MD Data Drive is surely quite impressive.

The impact of the Fluke 5500A Calibrator is perhaps a little more subtle, but having the opportunity to use it for a few days really emphasised to me how far we've come in the last decade or two, in terms of day-to-day measurement technology.

I can clearly remember when the first crude digital voltmeters became available, offering a big improvement in measurement resolution and accuracy over the 20,000Ω/V multimeters that most of us had been relying on until then. And it isn't so long ago that if you wanted significantly better accuracy again, you'd have to engage the services of a dedicated calibration/metrology lab, with its expensive collection of esoteric standards equipment and white-coated boffins.

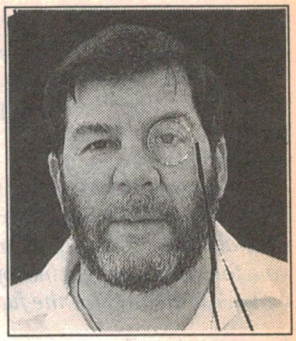
Now, thanks to firms like Fluke, any company or organisation with $20,000 or so to invest (less than the cheapest of today's new cars) can buy a veritable 'cal lab in a box' instrument like the 5500A — capable of being used very easily by almost any engineer or technician to calibrate a wide range of DMMs and other equipment, to a level of accuracy we could barely imagine, back in the 1960's.

We've come quite a way in the last few decades, haven't we? But to paraphrase Al Jolson in *The Jazz Singer*, don't go 'way, folks. You ain't seen nothin' yet, I'm sure.

Jim Rowe

Moffat's Madhouse...

by TOM MOFFAT



Gridlock on the Information Superhighway

This is a story about the Information Superhighway. Oh, no — not another one, you say! Yes, I know, I'm getting a bit sick of them too. But, contrary to all the stuff that's been flowing fast and furious in the popular press, we're not going to hype the highway; instead I feel we're about to litter it with a few flat tyres.

I got inspired to write yet another superhighway piece following some stuff that recently appeared on ABC-TV's *Four Corners*, some more in the newspapers, and what I've been reading in the computer magazines from both Australia and overseas. Taking all this information together, some rather disturbing trends are becoming obvious.

First to the *Four Corners* program, which I suspect might have had its genesis in a press release unleashed upon most of Australia's E-mail users by ABC radio. Here we had media proprietor Kerry Stokes expressing fear that Australia's part of the Information Superhighway might be taken over by dreaded commercial interests, both here and overseas. (See Moffat's Madhouse, April 1995.) Kerry Stokes featured prominently in the *Four Corners* program, as did other media proprietors such as Rupert Murdoch and Kerry Packer.

But they were small beans compared to the stuff emanating from Microsoft Chairman Bill Gates. It seems *he* wants to start up his own information superhighway, in direct competition with the current version, which exists in the form of the Internet.

Now, as we said back in the April Madhouse, "As it stands now the Information Highway, in the form of the Internet, isn't earning anything for anyone. There are commercial organisations providing ACCESS to the Internet for a price, but as for actual minute-by-minute usage, there is at present no mechanism for charging."

However Bill Gates wants to make sure every user pays, on his system. The Internet as we know it is a collection of computer sites all over the world, but none of them could be considered the 'centre' of the Internet, and no one body is in control of the Internet. It just exists, like the air we breathe.

Bill Gates' plan for his Microsoft system is to have all information stored at and distributed from one site — in Seattle, Microsoft's home town. Communication lines would then radiate out from the Seattle hub, all over the world.

It will NOT be possible simply to ring up this mega-site on the phone, log in with your modem, and use it. Apparently the Microsoft plan is to arrange the master site so that it does not talk in standard ASCII text; instead it will use its own proprietary code which can only be accessed via — wait for it — Microsoft Windows 95!

So, to become a user of Bill Gates' dream, you first have to buy Windows 95 to be able to access the system, and then you have to pay for everything you do on the system.

This means if you are using Windows 3.0 or Windows 3.1 or (horror of horrors) MS-DOS, you must heave them away and get Windows 95. And if your computer is something less salubrious than the latest model, that's gotta go too. New computers, new gleams in the salesmen's eyes.

Now who is going to be silly enough to pay all this money, to get what is virtually free on the existing Internet? Probably not many, but there is a solution, again as mentioned in the April Issue: 'One way to abolish free Internet usage would be to abolish the Internet. Then it could be replaced by a commercially oriented user-pays system.'

But the Internet, by its very nature, is uncontrollable. It's like weeds in the yard, you get rid of a few patches and others spring up to take their place.

Sit and watch?

However, it is becoming more and more obvious that there IS a way to get rid of the Internet: sit back and watch as it collapses under its own weight. All it takes is a little extra baggage, put there by enthusiastic users all over the world. It's called 'bandwidth'.

Bandwidth in the traditional sense means the amount of spectrum space taken up by a given communications channel. As the data rate increases, the width of the communications channel required to carry it increases too. A normal telephone channel is good for a data rate of not much more than 2400 bits per second; those higher bit rates of the latest modems, up to 28,800b/s, are brought about by fancy schemes that encode data in varying states. The raw data rate is still 2400 baud, or 'events per second'.

In the Internet sense, bandwidth refers primarily to the volume of data being carried, rather than its speed. Of course, higher speed lines are almost essential for higher data volumes if response time to a user's command is to be reasonable.

When I first started fiddling around with the Internet, it was pretty much an exclusive club, populated mostly by people within the academic community. Those of us not within that community could try the Internet only with the help of a university student, sitting in front of his own computer and probably lubricated with a few friendly beers. Back then (maybe three or four years ago), you could issue a command and there would be an immediate response, even if the remote site you were working with was on the other side of the world. It was considered nothing to download a file of several hundred kilobytes from somewhere like Finland.

Now, the Internet has become available to the public at large, and usage has thus increased many times over. Higher

bandwidth lines have been installed in some cases to cope with the increased volume of traffic, but the result hasn't been totally successful. Nowadays one must be prepared to wait and wait, as the packets of data creep along in bumper-to-bumper traffic on the Information Superhighway.

And it's not just the communications links; the remote computers themselves are sometimes horribly overloaded by multiple users all logging on at once. Take for instance Australia's 'Archie' server, the database containing the whereabouts of files all over the world available for download.

It used to be you could ask Archie to search for some file name, and in a couple of seconds it would snap back with a big list of sites where the file in question might be found.

Nowadays Archie might tell you you're number 20 in a queue, and then you sit and sit. Sometimes several minutes go by with nothing at all happening, and you give up in frustration. This is particularly terrifying if you're paying by the minute...

The beckoning Web

If you think the Internet's overloaded now, just wait: A new development called World Wide Web is taking over from the old text-based TCP/IP software. It's basically a graphic user interface (GUI), like Windows, combined with some multimedia features so you are presented with moving pictures and sounds, as well as written text. Many see this as a big improvement on the 'old' Internet protocol, with its command line and its somewhat screwy Unix syntax structure.

World Wide Web is 'point and shoot', a hypertext system similar to what you find within the Windows help system. Apparently you are presented with a screen of information from the Web, with certain options highlighted. You select the option you want with your mouse and click on it, and a further screen of information is sucked in from somewhere else. I must admit I haven't actually seen the World Wide Web work; at time of writing it wasn't available commercially in Tasmania. But I've done a lot of reading about it, and it's got me a little worried.

Since 'information' — World Wide Web-style — is basically multimedia, an awful lot of data must be transferred, sometimes from the other side of the world, to produce one pretty image on the user's screen and maybe some sounds as well. This means more Internet bandwidth, LOTS more.

As more users world wide begin using World Wide Web, the load on Internet data links will increase exponentially. My fear is that the whole thing might simple crack in two and sink, just like that America's Cup yacht *oneAustralia*, and that will be the end of the Internet as we know it — blub, blub, blub. And this of course removes the competition from operators like Bill Gates, who can then charge whatever they want for access to information we now get for free.

Should we begin re-thinking this whole multimedia trend, particularly its invasion of the Internet?

It is still my humble and somewhat backward opinion that information consists primarily of thoughts and ideas, exchanged between people as words. Pictures and sounds are nice, but are they essential to get the information across? I think not. How many pictures do you see on this page? I'm getting ideas across to you (weird as they may be) using simple words. And when you write complaining letters to the Editor about Moffat's drivel, you'll be using simple words too.

I do a lot of reading for entertainment — mostly novels, fiction, written by people who are very good at conjuring up images in your mind. Words alone can be very effective — have you ever read about a place, and then visited it later, to find it exactly as you imagined? I'm reading a novel at the moment, over 400 pages of it, without one picture other than the one of the author on the back. And I can still visualise every setting in that book in my mind's eye.

It's interesting to note that the common novel is even under multimedia assault now; in Japan for instance, recreational reading is almost always done nowadays from comic books, which are nothing more than 'multimedia novels'.

So, fellow Internauts, what say we look once again at what's happening to our cherished network. Do we really NEED all those pretty images and noises? Aren't simple words good enough? All you have to do is watch some errant Net user being 'flamed' to see how powerful simple words can be.

Compression scheme

All right, enough of that. Here's an idea which might REDUCE the bandwith requirements on the Internet, rather than increase them. Consider the structure of the English language, in fact most languages: They have upper-case characters, and lower-case characters. In normal text, upper-case characters are used only for starting sentences, and as the first letter in proper nouns such as names. Lower-case letters are used everywhere else. In the ASCII character set used by computers, there are 26 positions for upper-case letters, and 26 positions for lower-case letters. But, with English and many other languages, the upper-case characters are seldom used, and therefore are mostly wasted.

Followers of the television series *Star Trek* will be familiar with that race of other-worldly beings called the Klingons. Now it just happens that one of the many little gems available on the Internet is a discussion paper on the use of Klingon-ese as a second language. For instance: 'tlhIngan hol Dajatlh'a". To those already in the know, it is obvious that this means 'Do you speak Klingon?'. The appropriate response is, of course, 'HISlaH' (Yes).

Notice that in the Klingon language, upper and lower-case characters are used much more evenly; the upper-case characters are thus not wasted as much. With a bit more polishing of this interesting tongue, it should be possible to use fewer characters for a given word, since each character has 52 instead of 26 possibilities. Would this be hard to learn? I guess that depends on who you are... as the Klingons say, 'qay'be' (pronounced kyBE). Translation: no problem.

Hey, maybe this is the 'proprietary code' to be used by Microsoft on their new network! That means we've cracked that system before it even gets off the ground! Ah, the interesting things one finds on the Internet. Should we take them seriously?

Well, I'll leave that judgment up to you. Just remember that you heard about Klingon-ese first in a column called moFfAT!s MAdHOuSE. ❖

Australia's Radio Pioneers

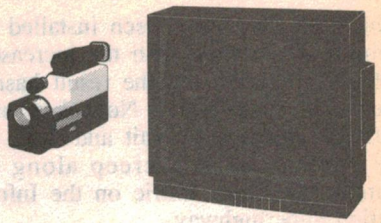
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What's New in VIDEO and AUDIO



'Monster Micro', affordable surround system from Philips

With 25% more power than their most powerful current mini system (in only half the size), Philips new FW17 micro audio system lives up to its reputation as the 'Monster Micro'.

Why Monster? "When you hear the huge 2 x 45W RMS (600W PMPO) sound output coming from its two way rear bass ported speakers, you'll know what we're talking about," said Philips Sound and Vision senior product manager Anthony Toope.

The FW17 was developed in a joint project between Philips Acoustic Laboratories and Philips Audio Development team. Aiming for the best possible sound within the strict size constraints of a micro, the subsequent technology advancements made by the designers have meant that the FW17 delivers sound quality comparable to systems much larger than itself.

The FW17 also has excellent features, with a single CD and full logic tape deck (DC synchro recording and remote control), plus a digital tuner with 30 presets. Sound is further enhanced with Dolby B Noise Reduction, plus the Digital Sound Controller which acts as a one-touch graphic equaliser with presettings for rock, pop, jazz or classical music.

For today's youth, the FW17 is the perfect system to get a party going, and its RRP of $799 won't blow the budget. At the same time its elegant styling and high quality features should also appeal to the older, more discerning audio consumer.

The FW17 Monster Micro is one of the Philips family of five micro systems, the others being:

- *AZ9055 Portable Micro System* with single CD and cassette, tuner, detachable speakers and remote, available from September with RRP $299.
- *FW11 Personal Micro* - 2 x 10W RMS (180W PMPO), two piece, super compact system with single CD and cassette, and tuner, available now with RRP $399.
- *FW12 Personal CD Micro System* - 2 x 12W RMS (200W PMPO) single CD and cassette, digital tuner, plus wake-up alarm and egg timer, so it's ideal for the bedroom or kitchen. Available from August with RRP $449.
- *FW15 Personal CD Changer System* - 2 x 15W RMS (280W PMPO) with programmable seven disc CD changer, single cassette, digital tuner and Digital Sound Control, available now with RRP $699.

Philips has also released the Home Theatre FR931PRO Pack, with an RRP of $999, claimed to be the first mass market home theatre package in Australia. Comprising the FR931 Dolby Prologic A/V Receiver and the PH931SSS five speaker surround sound speaker set, it is designed to deliver home theatre in a package accessible to the average Australian family.

The Home Theatre FR931PRO Pack works in conjunction with any stereo hi-fi VCR, or video laserdisc player, and a colour TV receiver. Video movies 'come to life' when their Dolby Prologic recorded sound track is replayed through the system. The listener is placed in a three dimensional sound field, which creates a compellingly realistic effect.

According to Anthony Toope, "Philips has made it easier for the consumer by selecting the products they need — components designed to work with one another — putting them together in a single package at an affordable price, and offering the package through all major electrical retailers Australia-wide."

It's a 'do-it-youself' kit, and any queries can be answered simply by calling Philips Customer Information line: Freecall — 008 803 312 — seven days a week. Any remaining uncertainties of installing the system can be removed by taking up Philips' $49 installation offer. With this a technician will go to your home, connect and install the system — and remove the packaging — all for just $49.

The FR931 Digital A/V Receiver, one of the components in the Philips 900 Series hifi audio range, is actually a stereo FM/AM tuner and amplifier. Its full A/V series remote control is RC5 compatible, and will therefore also operate most Philips TV receivers and VCRs.

In surround mode operation, the FR931 amplifier system provides two front stereo channels of 40W each, a 10W centre channel and two rear channels delivering 10W.



The Monster Micro FW17.



The FR931PRO Surround Sound System.

High quality subwoofers from REL

The highly acclaimed REL range of subwoofers is now available on the Australian market. REL claims to have taken subwoofer designs to current limits of technology by introducing a line-up of four designs, each incorporating its own high powered MOSFET amplifier.

The line-up begins with the Strata ($1995), employing a 60W RMS power amplfier with a single 26cm (10-1/4") magnesium cast driver with a frequency range from 20 - 120Hz.

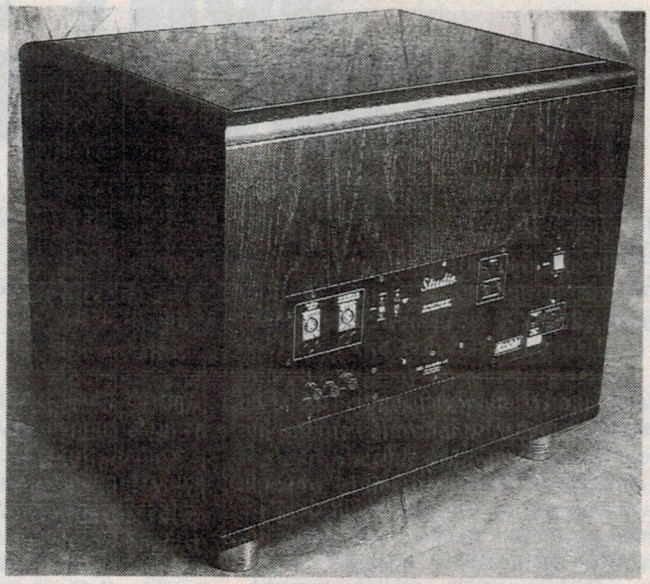
Next is the Stadium ($3595), employing a 100W RMS power amplifier and a single, 26cm magnesium cast driver with a frequency range from 18-120Hz. The Stenter ($6295) employs a 200 watt power amplifier, and 26cm magnesium cast driver offering a frequency response from 15Hz to 120Hz.

The Studio is the flagship of the line-up and features a massive 300 watt MOSFET design that drives the two floor-facing 26cm drivers. Weighing in at 81kg the Studio is the heavyweight, and is capable of reproducing frequencies down to 12Hz.

The REL subwoofers are all floor standing, bass reflex loaded port designs with downward facing drivers. All models are separated from the floor by four solid supports, in the form of sturdy tunnel legs to solid brass feet.

Depending on the model, the subwoofers can be connected to a hi-fi system via two ways. Either driven by line level signals, such as the output of a pre-amp, or directly from the main loudspeaker output terminals.

The REL subwoofer systems are covered by a five year warranty. For further information contact Kedcorp Pty Ltd on (02) 708 4388.



Audax speakers again available

Since the beginning of April, Audax Speaker Drivers are being distributed once more in Australia by ME Technologies. Audax Industries in France has been manufacturing high quality loudspeakers since 1926, the year after Kellogg invented the modern dynamic loudspeaker driver. The firm exports more than 80% of its production to Africa, Asia, Europe and North America. Now, Audax returns to Australia after almost a 10 years absence.

Audax compliments its traditional technologies of manufacturing, with innovating technologies to produce advanced state of the art loudspeaker driver designs. It has been well known among enthusiasts for not only their tweeter and mid range drivers, but their high quality kit designs. Over the last few years industry notables such as Vance Dickason have been employed to design even more sophisticated and polished designs. Special publications describing these designs are available from ME Technologies at no charge.

Audax drivers range in size from the micro 10mm tweeter to the 380mm professional HD-I woofer, grouped according to their applications. Among the product lines ME Technologies distribute are the Tweeter Line, Prestige Series, Reference Series, Professional and Car Lines. ME offers Audax speaker kits, which can either include all parts except boxes, or driver only kits.

Further details are available from ME Technologies, PO Box 50, Dyers Crossing 2429; phone (065) 50 2200 or fax (065) 50 2341.

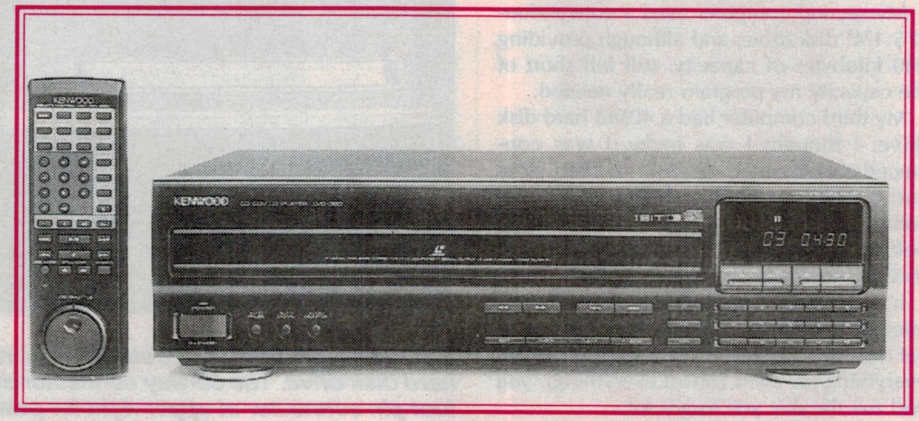
New Kenwood Laserdisc player

Kenwood has announced two compatible' laser disc players for both karaoke and home entertainment applications.

Priced at below $1300, both the LVD-380 ($1299) and the LVD-280 ($999) break new ground in terms of innovative features. Both boast Kenwood's 1-bit proprietary technology and are said to deliver exceptional sound. To enhance picture quality Kenwood employ a Digital TBC (time base corrector), which eliminates jitter for picture stability, and a special digital picture noise canceller for boosted picture clarity. The end result is described as beautiful picture sharpness with clear delineated lines.

Both models are designed to play CDs, CD videos and laser discs. The LVD-380 also provides S-VHS connection for use with high resolution monitors plus Direct Search, and Jog and Shuttle features. Karaoke users will find the convenience of Direct Search and Play an added benefit. The LVD-380 comes complete with an infrared remote controller with Direct Search, Jog and Shuttle, while the LVD-280 includes a 15 key IR controller.

The Kenwood LVD-380 and LVD-280 are all covered by a 24 month warranty (laser pickup 12 months) and are available from selected Kenwood dealers. ❖



SONY'S MINI DISC DATA DRIVE

This month, Louis Challis was able to try out one of the first samples to reach Australia of Sony's new MDM111-00/10 Mini Disc Data Drive. Squeezing no less than 140 megabytes of data into a tiny 70 x 68 x 5mm Mini Disc, the new drive is being eagerly awaited by many computer users for use as a backup medium. Here's what Louis found...

Back in September 1993 when Sony Australia invited the media to the Australian release of the Mini Disc System, I discussed the attributes of the new system with Gary Beauchamp. As we compared notes on a number of relevant issues, he let slip that Sony Japan were hard at work on a Mini Data Disc system which would revolutionise computer back-up storage.

"So!" I said, "What sort of data capacity will it offer?" He replied with a slightly hushed voice, "140 megabytes", and went further. "Are you interested?" "Of course" I replied immediately, "We (meaning the magazine) are extremely interested. How about giving us a scoop?" The response was not quite what I had hoped for, as Gary's response was, "I can't promise, but I'll see what I can do."

Well, almost two years later Gary (and Sony Australia) came good, and we received the latest, and possibly one of the most technically innovative *data* back-up systems which has been developed.

There are of course many other 'back-up systems' available. By way of example, the system I used with my first Hewlett-Packard computer used a data cassette with a 160 kilobyte capacity. It was slow, prone to a myriad of problems, and when it aged it suffered all sorts of geriatric problems.

My second computer used a conventional 5-1/4" disk drive, and although providing 360 kilobytes of capacity, still fell short of the capacity my program really needed.

My third computer had a 40MB hard disk drive. I thought I was lucky. I was convinced that I would be able to both store and access my data with the speed and convenience that I had never experienced before. I continued believing that until I had my first hard disk drive CRASH!

It was then I discovered that it's not enough to backup programs and some critical data on floppies. If you forget to backup everything (or even almost everything), you will rue the day you forgot to!

It was then that I purchased my first 44MB SyQuest removable backup system, followed by many more 44MB backup discs. Yes, they are good, they are generally reliable, but as you collect more and more data, and write more and more reports, you discover that those 44 megabyte SyQuest removable hard disks (in their protective cases) use an unbelievable amount of shelf space.

Yes, I know that there are some outstanding magneto-opticals and even 'flopticals' out there. However, the operating hardware for even the cheapest magneto-optical system costs in the vicinity of $1400, whilst their (lowest capacity) discs currently cost approximately $70 each.

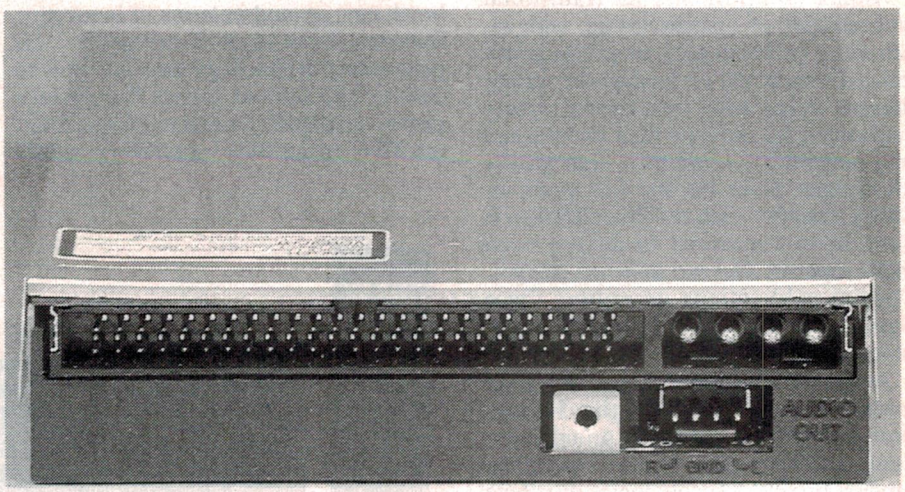
Enter Sony MD

Enter Sony, centre stage, with their exciting new Mini Disc Data Drive. The MDM111-00/10 competes head-on with a number of Sony's existing products. That presumably didn't worry Sony one iota, as this created an extended demand for the Mini Disc drives which have not had the market penetration hoped for.

Now, in order to connect the MDM111-00/10 to your existing IBM compatible computer, you need an appropriate ISA (Industry Standard Architecture) to SCSI (Small Computer System Interface) controller. If you have that controller, you can simply plug the Sony into the spare 3.5" diskette drive cavity and connect the controller's cable harness to the back of the Mini Disc Data Drive.

As you might well expect, I didn't have the appropriate ISA to SCSI controller, or even the alternative VESA SCSI controller, which would have fulfilled the same purpose. So I yelled 'HELP', and Anabelle Bits Pty Ltd came to the rescue with an 'Adaptec AHA-2842AK' (RRP $495) and an 'Adaptec AHA-1542CFK' (RRP $520).

The Adaptec AHA-2824AK provides a 32 bit, VL-to-Fast SCSI-2 host adaptor. It also theoretically provides high data transfer



The rear of the Mini Disc Data Drive is very similar to that of a CD-ROM drive or hard disk drive. The 50-way connector at upper left is for the SCSI bus, with the four pin connector at upper right for power and the audio outputs at lower right.



rates of up to 40MB/s on the VESA (Video Equipment Standards Association) bus. The Adaptec AHA-1542CFK provides a 16-bit Fast SCSI-2 host adaptor, which doesn't really provide comparable speed to the 32 bit adaptor.

Both of these units came with operating software on floppy disks, and we initially believed that the task of installing and integrating the hardware and associated software would prove to be a breeze. It just goes to show how misguided pre-conceptions can be! We discovered that the task was far more complex than we thought, and almost everything that could go wrong, did go wrong.

What I had hoped we would be able to do, would be to install one (or better both) of the Adaptec controllers into appropriate computers and derive objective measurements of the operating speed of the Mini Disc drive, using a range of conventional 'PC magazine' benchmark tests.

One of the first steps we took was to install the Adaptec AHA-1542CFK ISA to SCSI controller into a 386DX20 personal computer. But we discovered that as soon as the Mini Disc Data Drive was accessed, the computer locked up.

That problem was probably caused by an incompatibility between the controller and the computer. Rather than trying to chase what we feared was a fundamental incompatibility, we decided to use another computer. (Thank God we had enough computers!)

Our next step was to install the Adaptec AHA-2842A VL to SCSI controller on a 486DX33 personal computer. Regrettably this system, although initially functional, progressively locked up at random times. As a result, we were unable to successfully use it for our benchmarking program. That problem was most probably caused by the Taiwanese clone not being completely compatible with the SCSI controller.

We progressed further up the scale. We next installed the AHA-2842A in a Pentium 75MHz personal computer. Alas, at that critical moment the display card failed! At least we had proven that the Pentium computer was fully compatible with the rest of the system, before that (#*!?) display card failed.

We then tried installing the AHA-2842A into three different 486 computers, none of which proved to be completely compatible. We went further and borrowed another Pentium computer. Regrettably, although each of those computers was compatible with ISA and PCI, each of them proved to be incompatible with the VL standard.

Our next step was to install the AHA-1542CFK VESA SCSI controller into a 486DX2 66MHz computer, running on MSDOS v6.22. That computer had only 4MB of memory, which was all right provided that no low level benchmarks (track-to-track, random seek or data transfer times) were performed.

The first problem which we identified was the result of the MD drive being accessed as a MS-DOS device, which does not use the low level Basic Input/Output System (BIOS).

We progressed further and discovered that the Adaptec SCSI and the MD Data Drive set-up software both worked without incident after successfully installing the SCSI and MD Data Drive access software. The SCSI software occupied 5856 bytes of memory, whilst the MD Data software occupied 79,056 bytes. MS-DOS was configured to use the default number of disc buffers (15 x 512, i.e., a total of 7680). The HIMEM.SYS and EMM386.EXE were enabled, but with expanded (EMS) memory emulation disabled.

By default, the software was installed in what I would describe as the precious 'main' (conventional) memory section below 640KB. We later discovered that by manually modifying the AUTOEXEC.BAT and CONFIG.SYS files, it was possible to move the SCSI and MD Data Device drivers into the 'high' memory area (HMA) between 640KB and 1024KB. This approach worked without incident, and that was how we were able to successfully carry out our benchmark assessment.

Now, the Adaptec AHA-1542CFK controller has a built-in BIOS emulator for SCSI devices. Unfortunately this did not activate, because the controller didn't recognise the Mini Disc Data drive as a 'compatible system'. However, once installed as an MS-DOS device using the Mini Disc Data software supplied with it, the MDM111 was recognised as a 'network' disk Unfortunately this meant that it was no longer possible to boot the computer off the Mini Disc Data Drive. Only high level file read/write functions could then be performed.

Regrettably, conventional MS-DOS utilities such as FORMAT, SCANDISK and DEFRAG simply cannot be applied to the MD Data system. It does however come with a disk format program MDFORMAT (which is equivalent to the MS-DOS FORMAT program), and a file system check program MDFSCK (which is equivalent to the MS-DOS SCANDISK program).

Unfortunately, there was no equivalent of the MS-DOS DEFRAG (defragment), or the equivalent of Norton Disc Doctor included.

There was however, an MDCACHE program incorporated, which either enabled or disabled the internal write cache. We set the write cache to 'enabled' mode for all of the benchmark tests.

One last supplementary function which

was incorporated in the system, was an MDPLAY program. By activating it, you can play your standard pre-recorded mini discs and theoretically you can then 'listen to music while you work'.

Additional data

Sony Australia provided us with some additional information on the MDM111 Series MDDATA systems. The most significant features claimed for the MDM 111 Series are that the 2.5" magneto-optical (MO) disk is rewritable, with the potential for 10,000,000 passes before the disk reaches the end of its useful life (may you live so long!). The MDDATA system is designed to handle a wide range of digitised information, including audio, text, graphics, full motion video (which really caught my eye), and conventional computer data.

Sony intend to release special MDDATA disks which are in effect MD-ROM disks for electronic publishing and pre-mastered software applications. These will be supplemented by conventional recordable MDDATA disks for personal data storage.

The third type of disk which Sony intends to release, will be disks incorporating sectors that are recordable, together with sectors that are designed for 'read only' functions. These are obviously intended for interactive applications, to compete with CD-I software, which Philips are currently marketing.

The MDDATA disks will all use an original file system which allows the data disks to be used interchangeably between computers operating with different systems or CPU's. Obviously, Sony intends to release a Mac version soon, and other members of my family are just itching to try that version out.

The published data transfer rate for the MDDATA disk is 150kB/s, which enables recording or reproduction of CD full motion video. As we discovered however, the data transfer rate is closer in speed to a conventional discette, rather than to the performance of a conventional hard disk. On the basis of our tests (which have obvious and acknowledged limitations), the MDDATA disk is currently more appropriate as a back-up device than it is as a main system disk. Our tests lead us to the conclusion that a 100MB hard disk would take upwards of one hour to back-up, depending on which particular utility was being used.

Tests performed

Our tests evaluated the following parameters which are defined hereunder:

Average: An average of Cre, SeqWri, SeqRea, RanWri and RanRea.
Create: File creation
SeqWri: Sequential write to disk, for data which is contiguous on originating disk.
SeqRea: Sequential read from disk.
RanWri: Random write to disk for data that is scattered around the originating disk.
RanRea: Random read from disk.

Using those parameters and a conventional standard 130MB Maxtor Integrated Drive Electronics (IDE) hard disk and a 1.44MB 3.5" diskette, we carried out a benchmark evaluation.

The hard disk we used has a raw 1220KB/s transfer rate, a 16.7ms 'random track' seek time and a 4.3ms 'track to track' seek time. In Table 1, all of the benchmark values are presented as kilobytes/second, and thus the higher the number, the faster (or better) the performance is.

The heading NumSiz relates to the number of records transferred, together with the size of the records transferred — e.g., '64/4096' means that 64 blocks of data of size 4096 bytes were transferred. The total transfers in all cases was 256KB, and the results are three runs averaged to provide a more accurate result.

In running the tests we were not provided with documentary information on jumpers '124TP' on the rear of the MD Data Drive, which were probably to set the drive's SCSI address (0-7). There was also a potential confusion as to its termination (enabled/disabled) and parity (enabled/disabled).

As we discovered, the MDDATA drive's eject button will work even while the disk is being accessed. In one respect this is good, because it allows you to abort a data transfer if you need to. Hopefully the control software makes sure that the disk is not corrupted with incomplete blocks of data. That however, was one issue that we were unable to positively confirm.

I would have liked to use the most recent version (V.9) of the *PC Magazine* lab benchmarks. Regrettably, the software did not allow the network disk to be selected. *PC Magazine* lab's V.6 software was run, and it provided the above results.

Mini Disk Data Benchmark Results

Disk	NumSize	Average	Create	SeqWri	SeqRea	RanWri	RanRea
HARD	512/512	40.36	28.09	28.53	80.41	33.68	31.07
	64/4096	183.81	168.20	181.18	172.74	202.84	194.12
	16.16384	403.64	351.19	398.47	378.76	452.52	437.26
	8/32768	538.08	499.96	558.54	468.32	581.81	581.81
MDDATA	512/512	22.87	5.51	11.78	92.53	1.07	3.47
	64/4096	44.10	37.09	28.48	118.62	11.07	25.24
	16/16384	58.40	39.65	34.39	132.04	26.69	59.27
	8/32768	60.61	40.30	32.44	136.11	35.50	58.71
1.44 Mb	512/512	2.81	2.40	2.41	2.42	3.33	3.47
	64/4096	11.93	11.40	11.76	11.90	12.08	12.50
	16/16384	21.56	19.15	21.77	22.51	22.16	22.20
	8/32768	24.02	22.00	24.01	24.83	24.30	24.96

The measured performance parameters for the Mini Disc Data Drive, shown for comparison against those for a hard disk and a 1.4MB high density 3.5" floppy disk drive. The significance of each parameter is explained in the text.

Conclusions

Like the original CD data drives, the MDDATA system is closer in speed to a diskette than a hard disk. Although Sony's blurb claims that it is designed for 'full motion video', I suggest that what they mean by this is that it is capable of handling MPEG-1, or other compressed video data systems which have been developed, or are in the process of being developed.

The MDDATA system is currently better suited for use as a backup device than it is as a main system disc. Even when used as a backup disc, the system is not all that fast. However, it does have one major advantage, which is the speed with which it can randomly access data in a way that no tape backup system can currently match.

As we discovered, the 85KB of memory resident driver software must be installed before the disk can be accessed. In an environment with other devices connected to the PC with their own driver memory re-

quirements, this may well prove to be a limitation.

Since the MDDATA system doesn't fully emulate a PC disk, some tried and true system programs can't be used with it. In most environments this is unlikely to prove to be a problem. One common and convenient option that is available to you on your hard disk is using DoubleSpace (DBLSPACE) or DriveSpace (DRVSPACE) to double the disk's effective capacity; this is just not achievable with the MDDATA system.

If the MDDATA disk should ever become corrupted, then you are dependent on the MDFSCK program to recover the data. Regrettably third party programs, such as Norton Disc Doctor can't be used (at least for the time being).

As we noted during this review, the SCSI controllers are finicky and you may well experience problems installing one in your PC. Make sure your PC is fully compatible before you part with your money, as otherwise you may be embarrassed. Notwithstanding that caution, most recent PC's and in particular 486 and Pentium computers are likely to be fully compatible.

We found that the MDDATA system is very compact, 'clean' once installed, and is extremely good when backing up and restoring small files. This capability in particular, is potentially the most important and that which will endear it to non-commercial users.

The second important capability is that the MD Data Drive is the smallest and neatest data storage system that money can buy. It's smaller than a DAT tape drive, and exhibits none of the inherent limitations and access problems of DAT.

On a cost-for-cost basis, I suspect that there is no other system that can match the MDM111 system for convenience or media storage cost. The question of initial capital cost remains the only issue which is yet to be resolved, and that in turn will ultimately be determined by volume sales and future competition from other 'look alike' suppliers.

The MDM111-00/10 Mini Disc Data Drive is available on order from the Data Products Division of Sony Australia, which has offices in each state. The quoted RRP for a drive plus matching software drivers (for either an IBM-compatible PC or an Apple Mac) is $965 ex tax, or $1165 including tax. At the time of going to press, the cost of the recordable Mini Data Discs themselves was not available.

Our thanks again to Adaptec distributor Anabelle Bits Pty Ltd, of 5-15 Dunning Avenue, Rosebery 2018, for loaning us the SCSI controller cards used in reviewing the MD Data Drive. Incidentally if you need a SCSI controller for your own computer, Adaptec is one of the leading brands. ❖

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Vifa Speaker Drivers:	Was	Now
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831663 8" polycone woofer	$99	$49
831650 6.5" polycone woofer	$79	$39
831680 6.5" High quality polycone woofer	$148	$69
831701 8" High quality polycone woofer	$179	$89
831531 10" polycone woofer	$169	$89
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READER INFO NO. 2

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As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and rapid downloading by readers equipped with a personal computer and modem. We know that a high proportion of our readers have these facilities, nowadays.

Here's an idea of what's currently available on the BBS:

- Software needed for recent PC-based EA construction projects
- Index files for EA and ETI construction projects
- Recent notes and errata, both published and as-yet unpublished
- Useful public domain and 'shareware' software for electronics and amateur radio applications.
- General interest shareware utilities, such as the commonly-used compression and decompression utilities used for faster file transfer.
- The ability to upload Letters to the Editor, and/or contributions to our Forum and Information Centre columns (send them as plain-text ASCII files, please)

Soon we hope to have an on-line 'Discussion Forum' facility in operation, to allow readers to exchange useful technical information directly.

The *Electronics Australia* Reader Information Service BBS is ANSI-compatible and is currently operational for virtually 24 hours each day, seven days a week, on (02) 353 0627. Your modem can be set to any standard speed from 300 to 28,800b/s full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit).

So feel free to call up the *Electronics Australia* BBS, and take advantage of its facilities. There is no cost for accessing the system itself, which is provided purely as a service to readers. Your only outlay will be the usual cost for a phone call...

AND NOW LIVE FROM CHINA - 2

Last month, we followed the adventures of a group of intrepid television engineers and production personnel who had travelled to China with the American NBC company, to do the first live TV transmission from that country. This month Bryce Templeton continues his story with the preparations in Beijing and Shanghai.

by BRYCE TEMPLETON

It had been determined that the Evening News would be done live to New York, and the Today show would be done later and recorded in New York for replay at the correct time. Eastern Chinese time is not much different from Australian time, so the News would have to go at 7am the morning of the day after it is seen in the US — if you follow that.

'Today' would be done at 3pm. This would allow us sufficient time to move the trucks and set up again between each show, but the move on Thursday afternoon to Shanghai was looking very ominous. As the News was not very complicated — little more than a 'talking head' — a separate small production team was appointed to handle that, using a small one camera truck, with the main team in the large truck only doing 'Today'.

Back to the work in hand, the time had come to move the OB trucks to the first site, a large courtyard inside the Forbidden City. They were duly placed in position along with an enormous diesel alternator, operated by an American from the deep, deep south named Denny the Diesel. It was rumoured that he did speak English, but I never was able to conduct a conversation without an interpreter.

The ground station was established in another smaller courtyard of the Forbidden City. The satellite that was to be used was very low on the horizon, and required an azimuth angle of only about 14°. Humorous observations were made about the people in the apartment block it skimmed being able to warm their Dim Sims by microwave, using a long fork out of the window.

This set-up was complicated by the fact that the truck was about 200 metres away from the actual broadcast area, as it could not be taken over a 1000-year-old stone bridge — the Chinese quite rightly fearing the worst.

All the miles of cables that we had spent the previous week making were now run across the bridge, and the area was set up. This first broadcast was to have an audience of Chinese officials and other celebrities, and as such required many seats and a PA system, so they could hear.

There was a technical run though, and no obvious faults were noted. An area near the front of the audience was reserved for the as-yet non existent PA operator and his mixer, and several speakers driven by two large power amplifiers were set up in the designated audience area.

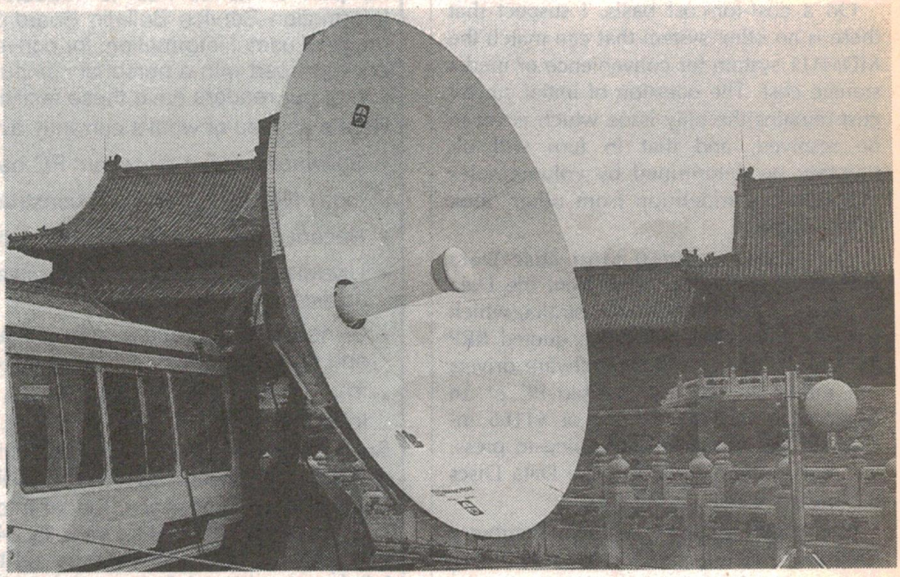
The director took a cursory glance at all this, and declared it OK. This director was held in the highest esteem by the American engineering staff (much higher than we would grant to Australian directors), and while we thought that all this boot quaking and hem-of-garment kissing was a bit over the top, we went along with it...

I have never had much faith in these rehearsals, as directors do not seem to be able to get into the mood unless there is tremendous pressure upon them. Often they will let things pass that are going to really worry them, when the real thing is happening. Still it is gratifying to see that mostly it works, and mostly everyone is happy.

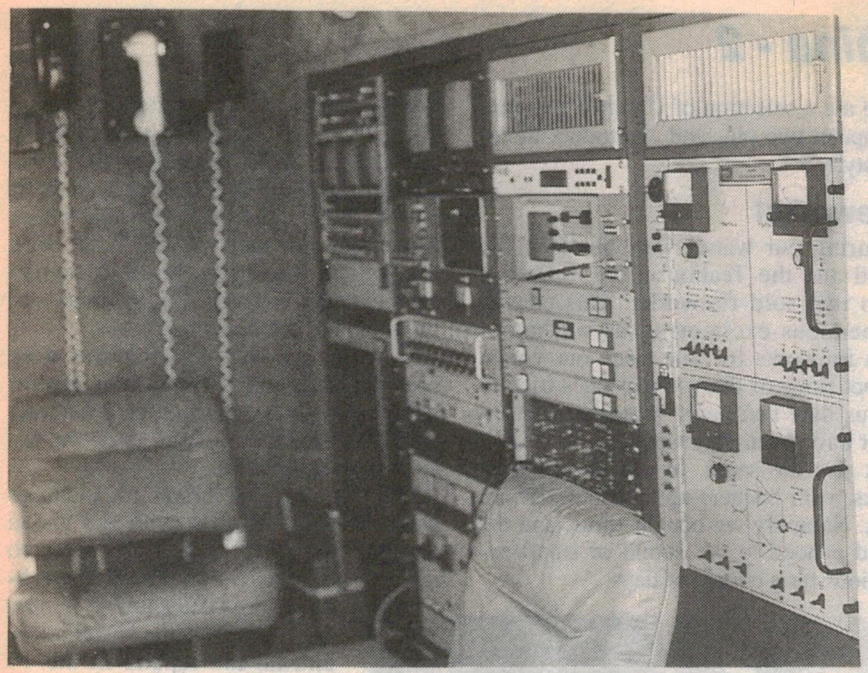
The truck was disconnected and returned to the compound. It had been discovered in its short journey that the air suspension was leaking, and this air leak was affecting the operation of the brakes. The unintelligible diesel operator and another mechanic disappeared beneath it for a day or two, muttering about the availability of spares for American trucks in China.

The Great Wall

After repairs were completed we had a technical setup at the Great Wall site, in the small town of Badaling — one of the few gateways through the wall, and about an hour's drive from Beijing. This setup



The ground station in the Forbidden City, Beijing. This provided forward and reverse video and audio circuits along with telephone and fax communication to New York, and shows the low angle required. The small dish to the right is the link to the OB van in Tian-an-men Square. Immediately behind the van is the moat that prevented further access for vehicles (Photo courtesy Greg Evans.)



The interior of the mobile ground station used for the broadcasts. There was no shortage of equipment. (Photo courtesy Greg Evans.)

was not all that complicated, except for a requirement for a camera about one kilometre along the wall with a shot back to the main area. A cameraman and assistant were duly dispatched to trudge along the top of the wall to their distant perch, loaded with a portable alternator, the camera, a radio and a small microwave link.

This journey is much harder than it looks, the path on the wall being very steep in parts, with stairs and battlemented towers to contend with. However they made it, spent an hour or so establishing the link and sent us back pictures. Again the director seemed more than happy with the technical arrangements.

We went for lunch to one of the many restaurants in the town, and one of the dishes was a large whole fish. After a suitable pause our Chinese hosts asked if anyone wanted the eyes. Maintaining as much decorum as possible, we politely declined, and they were carefully removed and eaten with great relish. The rest of the fish was fine, though.

After lunch we had a stroll though the town, which has a market type of atmosphere. It was crowded with stalls selling tee shirts, lace table cloths and other souvenirs.

Tian-an-men square

The truck was then moved to the second site, the memorial in the center of the giant Tian-an-men square.

There was requirement for a microwave link for the broadcast from the Tian-an-men square site to the satellite site still in the Forbidden City, and the Americans were negotiating furiously for permission to have a repeater on the front wall of the City, just to the left of the portrait of Chairman Mao. This was too much for the Chinese officials, and no amount of persuasion would allow this to happen; so we had to move the truck slightly, to allow a link to be set up on the roof to shoot to a hill behind the City, and back down to the ground station.

The setting up of this link path, normally the work of a couple of hours, was complicated by the fact the smog had become so bad that visibility was reduced to a kilometre or so, and the remote link site could not be seen with binoculars to enable an easy alignment. After many hours and much trial and error the path was established, much to everyone's relief.

I had been designated to stay at the remote camera site feeding this link path, and whiled away the hours sending back shots of young ladies strolling in a park, to 'cheer up the lads'.

Perilous journey

After about two weeks in Beijing, the engineering team went to Shanghai to inspect the setup there. This involved a trip on a chartered Chinese military plane of Russian origin. The three hour trip became a drawn out extravaganza that started when we got lost on the way to the airport.

The bus driver, who smiled and nodded furiously when asked if he knew where he was going, went to the wrong military camp — where we were viewed with ill-disguised suspicion by soldiers with guns. It continued with us becoming bored as we waited at the *right* military field, for the plane that finally arrived five hours late. During this wait we discovered that our guide/ translator, a girl of about 25, had never seen a plane on the ground before.

We were unimpressed when the internal lining of the door of the plane fell off during take-off, and we were unsure of the navigator's skills because of the way that the pilot kept coming down to below cloud level after bad weather set in. This caused stomach-churning bumps, and looked suspiciously like he was trying to catch a glimpse of the local landmarks. The cabin crew consisted of a university student who was doing a type of work experience for the military. She didn't give us dinner or coffee, but we *did* get an apple and a carved wooden Chinese fan(?).

We made it to Shanghai eventually, to be met in the rain by some more of the incredibly large NBC office staff. Then we continued our journey, now 10 hours long, to the Sheraton Huating hotel which was where the American executives were staying, and where they had established their command centre. The hotel is a landmark in Shanghai, as it has an external glass lift on the front, and the locals seemed to consider it a good night out to sit and watch this go up and down.

Due to the lateness of the hour, we remained there that night, and continued the next day to the venerable Peace hotel, last seen in the movie *Empire of the Sun*.

The Bund

The link and satellite people had been here before us, and had set up an impressive ground station on the Peace hotel roof and an upper floor suite, which was connected into the NBC headquarters in New York and via them to any NBC station in the US. It also had been patched to their phone network, so our calls to home went via the US!

Cables had been hung over the world's busiest road, connecting the OB truck site to the ground station, and a link had been established to the Sheraton Huating hotel, several kilometres away, so that they also had instant access to NBC New York.

After checking in, we went to view the engineering facilities, which proved to be an even more decrepit truck than the one in Beijing. It was ex the American football circuit, to judge from the wall decorations. This setup did not have to move, as all the Shanghai broadcasts were to come from the same site in the Bund, a riverside park across the road from the Peace hotel. There were to be a

And Now, Live from China - 2

few other sites, but they were within a few hundred metres of the truck, except for one that was to be connected by landline to it.

This latter site was the famous Shanghai Tea Rooms, an elaborate building surrounded by a lake. When we went to find the cable termination, supplied by the Shanghai Telecom, we found ourselves to be the centre of attention, which means in Shanghai that you are surrounded by hundreds of people wherever you move.

The cable that we required proved to have been thrown up on the awning of a shop by the telecom men, and getting it down was a bit of a task. After many offers of help and advice, most of which we couldn't understand, a small ladder appeared though the throng, and we were able to hook the cable off the awning.

While we sat on the ground attempting to sort out the pairs and establish contact with the truck, the crowd grew and grew, and our space became less and less. Finally claustrophobia took over, and we had to postpone our efforts to a less popular time. We had however managed to prove the audio and communications circuits, and the video circuit we hoped to do later.

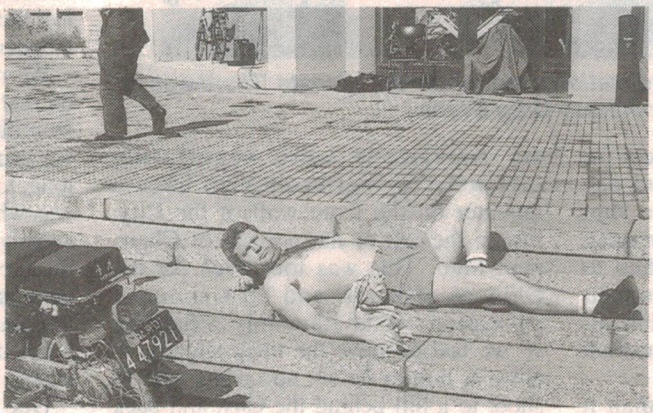
Shanghai has such a high population density, that is impossible to describe to Australians the feeling of being constantly surrounded by people at all times. Try to imagine a grand final crowd, 24 hours a day and seven days a week, milling about your city.

The Americans, being as they are, don't accept that there are power voltages other than 110V. So they had brought numerous portable alternators and a couple of very large diesel alternators to power everything — as they said, they had no faith in the local supplies, especially in Shanghai.

At first I thought that this was just being 'American', but on close inspection of the system in Shanghai, there may be some basis for their scepticism. The supply wires are not on poles in many areas, but loop from building to building at the second story level. There was plenty of evidence of 'auxiliary' installations being connected by leaning out of the window and twisting onto the passing wires with a bit of figure-eight cable, and taking this inside through the window. Mains connectors were a problem too, as there are a selection of US style two-pin, European two-pin, and Australian three-pin style.

Fireworks!

During our wanderings between the Bund and the Teahouse, we noticed a shop that sold fireworks. This caused tremendous excitement, as we hadn't seen fireworks for sale since our youth. In fact some of the younger ones tried to tell us they had *never* seen them, but it can't have been that long ago. They still look just the same, in red tissue paper packs, with bangers up to about 100mm long. Naturally we bought some, and the Bund echoed to the sound of small explosions for a couple of days.



Australian cameraman Andre Blundel relaxes. In the background is the building that was the site of the 'great cracker experiment'. (Photo courtesy Greg Evans.)

Another, this time smaller, warehouse had been established in a sporting arena near the Sheraton Huating, and we again spent a few days making cables and checking equipment. Then we returned to the truck, to see what we could make of it.

This truck was more of a problem than the other, as it seemed to originally been designed to be the production half of a two-truck setup. This half contained the vision switching area, the sound area and a small patching area; the other half, which would have housed all the camera control units, frame stores, video tape machines and communication equipment, was no doubt rotting on a rubbish dump in Houston or somewhere.

So the half *we* proudly owned did not have any room for most of the stuff we wanted to put into it...

It would appear that the original idea may have been to always have the Beijing and Shanghai trucks together, moving them between the cities. But this was not possible in the time frame now planned.

After many inspections and much consultation, it was decided to do several alterations to the Shanghai truck by building a walkway beside it and a small extension at the rear, and to fit the VTR's into the rear section where the cables normally would have been carried. It was also decided to use another small van as a comms room, and yet another truck as a store.

A rough systems drawing was duly sketched out, and we set about assembling the truck as we had done in Beijing. Carpenters were brought in to do the extension and walkway.

The work was not completed, and there was a serious problem with the vision mixer, when the time came for us to return to Beijing. So an American technician was delegated to remain and complete the installation, and do the repairs in the 10 days or so until we returned.

Mao's Tomb

During our days at Tien-an-men Square, we had noticed the Tomb of Chairman Mao Zedong — an impressive structure that dominates one side of the Square, directly opposite his portrait over the Forbidden City gate. There was always a queue of several hundred people waiting to view the Chairman's remains, and we determined that we would like to have a look.

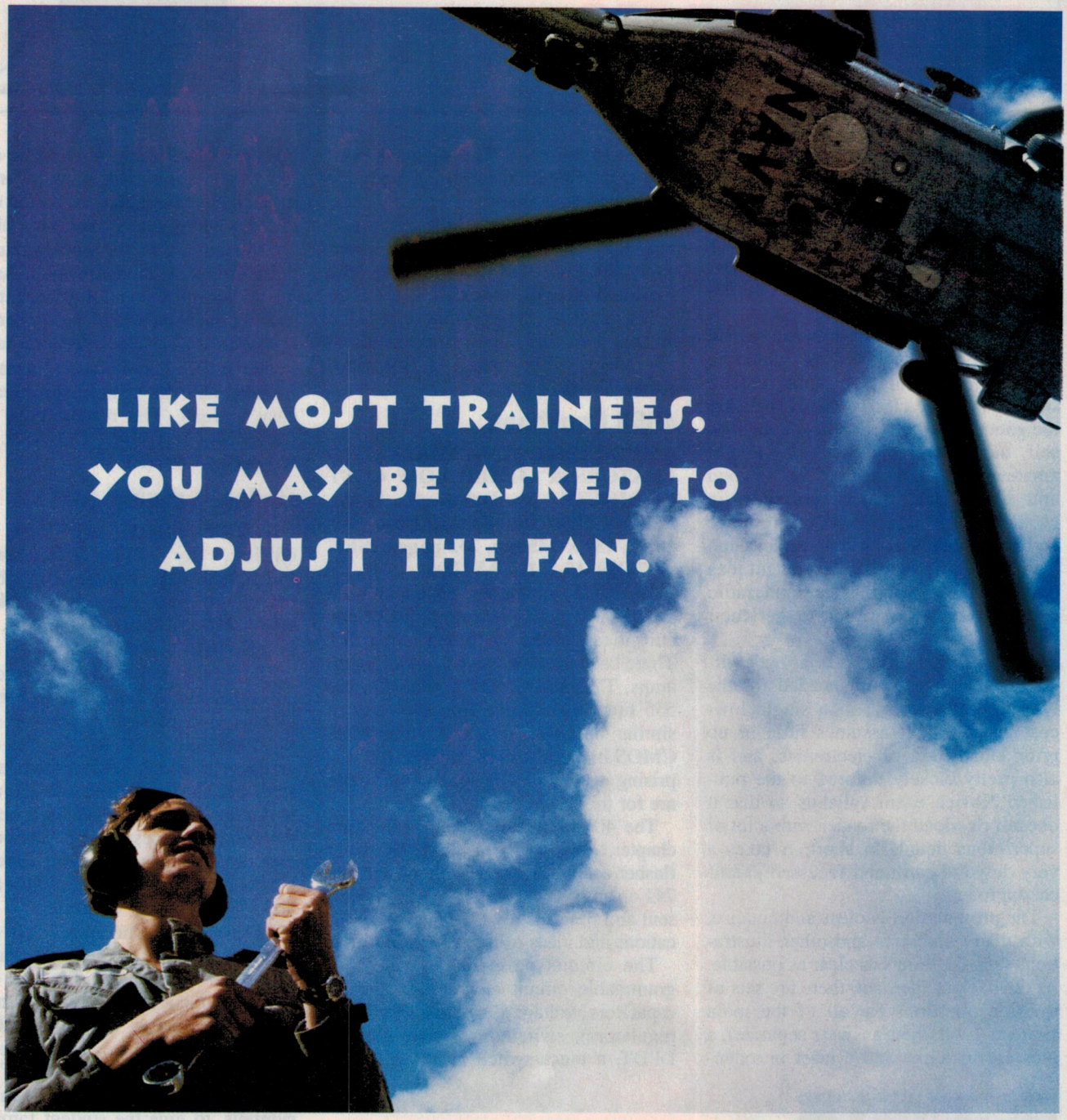
When we had a spare few hours, we took our place at the end of the queue. We had only been there a few minutes when a couple of the police/soldier guards appeared and indicated that we should follow them. This we did, wondering if we had committed some terrible social blunder by standing in the queue.

Were westerners not permitted into the Mausoleum? Was this the beginning of a dramatic international incident that would eventually involve the US president or even Bob Hawke?

But no, we were led to the head of the queue and politely ushered in as VIPs, much to our embarrassment. We never found out why this happened; maybe it is a courtesy offered to all western tourists. Anyway, it was greatly appreciated. Chairman Mao lies in a glass enclosure and is honoured with great reverence and love by the Chinese people.

Next month the great day (or actually, week) comes, and our fearless team begin to have production problems.

(To be continued) ❖



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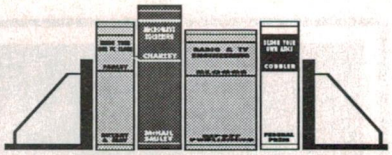
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READER INFO NO. 3

NEW BOOKS



Amateur radio

THE NOVICE OPERATORS THEORY HANDBOOK, second edition, by Graeme Scott VK2KE. Published by Thomson's Printing, 1994. Soft cover, 297 x 210mm, 96 pages. ISBN 0-959-3726-01. RRP $14.00.

The first copy of this very successful Australian handbook for the would-be novice radio amateur sold 10,000 copies, showing clearly that it 'delivers the goods'. As well as being a ham himself, author Graeme Scott has taught amateur radio courses at Collingwood and Box Hill TAFE colleges in Melbourne, at Wodonga TAFE college and also at the Twin Cities Radio Club in Albury — so he has an excellent idea of what the newcomer to ham radio needs to know, in order to get their Novice licence.

The aim of the book is to provide virtually all of the theory needed for the Novice theory exam, in a single low-cost handbook. It assumes little or no prior knowledge of electronics, and is also pretty closely tailored to the published Novice exam syllabus so that it doesn't overload the reader with a lot of superfluous detail. In short, it takes a very down to earth and focussed practical approach.

The presentation is clear and concise, with many diagrams and other illustrations to make things as clear as possible. At the back of the book there are sets of revision questions for all of the main chapters (with their answers separate), a glossary of terms and a brief introduction to Morse code. The author is even able to provide Morse learning tapes, for those who want them.

Overall, an excellent little book, and one that should provide just about everything needed for passing the Novice licence theory exam.

The review copy came from the author, who can supply readers direct via Megjay Pty Ltd, PO Box 385, Albury 2640. (J.R.)

4066 Cookbook

AMPLIFIERS, WAVEFORM GENERATORS & OTHER LOW COST PROJECTS, by Delton T. Horn. Published by Tab Books, 1994. Soft cover, 187 x 235mm, 232 pages. ISBN 0-07-030415-7. RRP $42.95.

Technical 'cookbooks' have long been a popular way of presenting lots of circuit ideas based on a particular IC. There have been cookbooks covering op amps, TTL and CMOS digital ICs, the 555 timer and so on. This book uses a similar approach to the popular 4066 CMOS bilateral switch. In fact, it's surprising just how many applications there are for this IC.

The 4066 IC is described in the first chapter, along with the LM3909 LED flasher/oscillator, the 555 timer and the 741 op amp. The remaining chapters present and describe a wide range of applications and ideas using these four ICs.

The circuits presented include programmable circuit elements (resistors, capacitors, voltage dividers and voltage regulators), switching circuits (SPDT, DPDT, a touch-switch array, etc.), circuits to digitally control an audio amplifier (digital gain control, output switching), signal generation and sound effects circuits, and digitally controlled filters.

Each circuit in the book includes a parts list and a full description. As well, the author presents a lot of basic theory, making the book useful as a general reference as well as a source of circuits.

The writing style is informal and friendly and the circuits are clear and easy to read. The review copy came from McGraw-Hill, PO Box 239, Roseville 2069. (P.P.)

Updated digital text

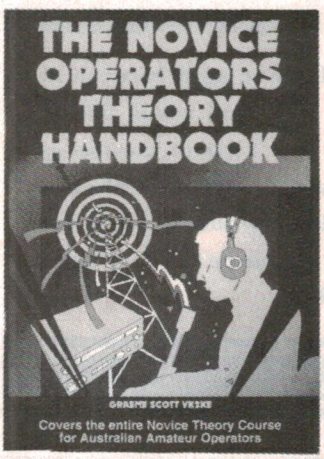
DIGITAL LOGIC DESIGN, third edition, by Brian Holdsworth. Published by Butterworth-Heinemann (Newnes imprint), 1994. Soft cover, 216 x 136mm, 596 pages. ISBN 0-7506-1615-6. RRP $52.00.

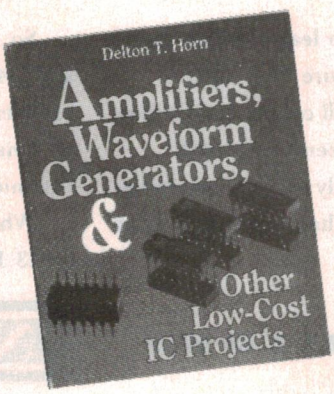
This is the revised and updated third edition of a book that has been very popular as an introductory text on digital logic operation and design, for undergraduate university and technical college students. The author believes that a good grounding in the basics of logic design is still important, despite the heavy dependance nowadays on MSI functional blocks and programmable logic arrays, and I have to agree with him.

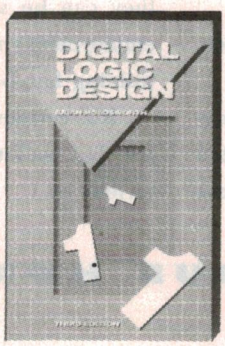
In this edition he covers all of the usual basics of combinational and sequential logic design, but also covers modern design and implementation approaches using MSI elements and programmable devices. Along the way he presents both the 'traditional' logic symbols and the newer functional logic symbols, to give the student familiarity with each. Overall, these features make the book both comprehensive and reasonably up to date.

The book appears to be thorough and concise, and each chapter ends with a set of revision problems. The answers to these are given in the back of the book, where there is also a bibliography for further reading. In short, then, it would make a good choice for a modern text on basic digital logic.

The review copy came from Butterworth-Heinemann Australia, of PO Box 5577, West Chatswood 2057. (J.R.) ❖





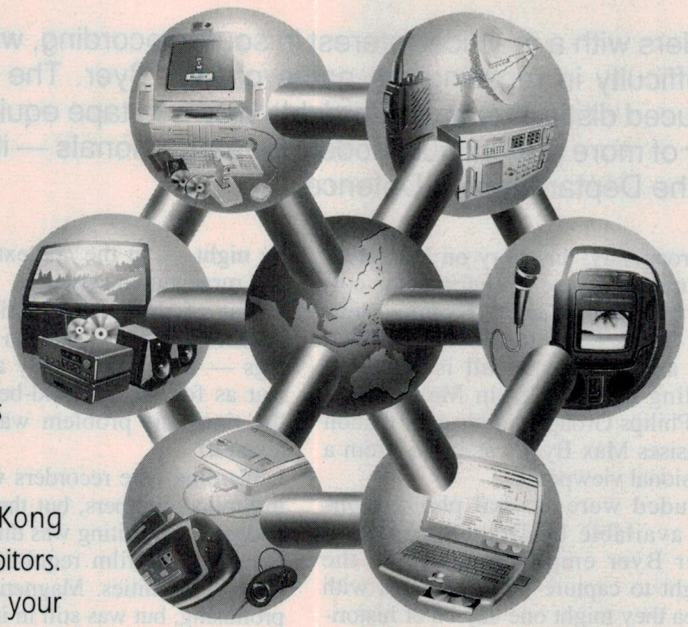


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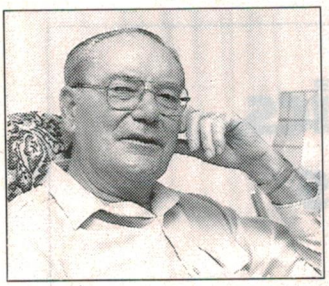
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READER INFO NO. 4



When I Think Back...

by Neville Williams

MAX BYER: Well made equipment for amateur and professional recordists

Readers with a practical interest in sound recording, who can look back to the 1950's, should have no difficulty in recalling the name of Max Byer. The Melbourne based enthusiast/manufacturer produced distinctive and affordable disc and tape equipment for amateur recordists, along with an array of more pretentious models for professionals — including the ABC, commercial broadcasters and the Deptartment of Defence.

Appropriately, this story on Max Byer relies in large degree, on information collected by Harry Mauger. Featured himself in 'Think Back' for November 1994, Harry as you may recall is a retired recording engineer from Melbourne's Astor/Philips Group, and his contribution emphasises Max Byer's activities from a professional viewpoint.

Included were several photographs made available by Doug Richards, a former Byer employee who had the foresight to capture factory scenes with the idea they might one day be of historical value.

For my own part, the article also involved an exercise in recalling the past — but from the hobbyist level. Back in the 1950's, I was a professional technical writer by day, but with a strictly amateur spare-time interest in film and slide projection, stage presentation and music by night — in the context of suburban and rural church actvities.

Out of this latter activity came a hankering to make my own sound recordings — also on a strictly amateur basis. But as for other would-be recordists at the time, the problem was: how to go about it?

Wartime wire recorders were available in limited numbers, but they were fiddly gadgets, and editing was difficult. Optical recording on film required professional back-up facilities. Magnetic tape looked promising, but was still in its infancy outside Germany. That left direct recording on lacquer-coated discs as the obvious choice; blank discs were in good supply (Fig.1), as also were steel and sapphire cutting stylii.

Looking back, I remember seeing an advertisement for an overhead tracking and leadscrew mechanism to propel a recording head across a blank disc — and I was hooked!

I reckoned that I should be able to contrive a make-do recording head from a 78rpm magnetic pickup, and drive it from an ordinary amplifier. To set up a suitably husky turntable should be a breeze for my younger brother, trained as a machinist and with access to machine shop facilities.

How NOT to do it!

In due course, we had a 16-inch steel turntable, with spindle and bearing, balanced and true to within a 'whisker'. It was set up in a stout wooden frame, provided with rim drive using an available synchronous motor and topped off by my overhead lathe mechanism. Fitted with an improvised recording head and a commercial cutting stylus, it was ostensibly ready to inscribe our first clean, unmodulated test groove.

Unfortunately, the aforesaid 'test' groove proved to be anything but clean — displaying a plainly visible 50Hz vibration pattern. Apparently, the overhead traverse mechanism, bridging from the turntable spindle to the wooden frame, was reacting to residual vibration in the assembly and transferring it to the cutting head as a whole.

My brother and I had learned the hard way that the construction of a recording lathe called for a higher level of refinement than we had allowed for!

It was at about that time that I first sighted what was loosely identified as Max Byer's 'Junior' disc recorder. Mounted in a wooden box with lid and carrying handle (Fig.2) it looked rather

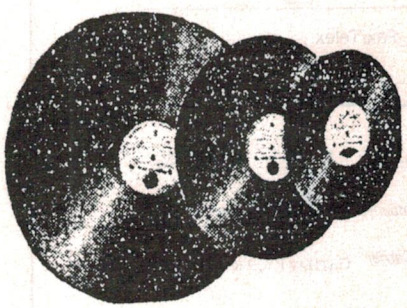


Fig.1: Recording blanks were in ready supply in the early 1950's, as for example these Byer/BRS blanks advertised by Homecrafts.



Fig.2: Looking much like a portable record player, this Byer disc recorder was capable of excellent results at an amateur level.

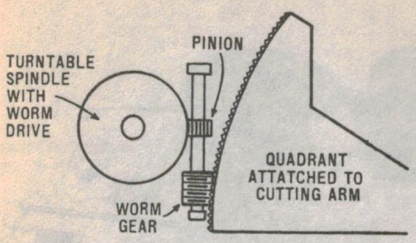


Fig.3: From the May 1951 issue of R&H, this diagram (complete with spelling error) shows how the turntable spindle of the Byer portable recorder drove the cutter radially across the disc, using a worm and sector mechanism.

like a portable record player of the era, to be hooked up to the family 'wireless'; a trifle larger, perhaps, and a little heavier, but much less cumbersome than our own ill-fated creation!

As I recall, that first Byer recorder had a 12-inch (30cm) diameter turntable, diecast, machined and topped with a synthetic rubber mat. Following 78 rpm practice, it was a single speed unit, rim driven from underneath by a compact, purpose-built phono type motor.

Lifting the lid revealed what looked like an old-style magnetic phono pickup, with needle chuck and thumbscrew to accommodate interchangeable play/cut stylii. It was described as a combination pickup/cutter, but as a pickup it was in stark contrast to the new lightweight pickups being publicised at the time by firms like Goldring and Acos.

(There and then I/we decided that, if we ever did cut an acetate on the Byer, it would be replayed using the most compliant, lightweight pickup we could find, such as the Acos GP-20).

Worm & sector drive

The Byer 'Junior' had no overhead traverse mechanism. Instead, the pick-up/cutter was locked to a spindle supported by a bearing through the assembly plate and carrying a sector vane underneath, as shown in Fig.3, reproduced from the May 1951 issue of this magazine, then known as *Radio & Hobbies*.

In cutting mode, the vane engaged a worm drive from the turntable spindle, which drove the sector and hence the attached cutter radially across the disc, producing the required spiral groove.

In the Byer recorder, the mechanism was normally set up to drive the stylus from the label towards the outer edge of the disc, leaving the 'swarf' (lacquer 'string' removed by the cutting stylus) behind in the recorded area — hopefully clear of the stylus as it nudged its way progressively outwards.

Needless to say, my first reaction on encountering the disarmingly basic looking Byer recorder/player was to install a recording stylus and blank disc, and cut a plain groove. Despite the economy of design, the groove turned out to be visually 'clean' — evenly spaced and with no sign of mechanical vibration or 'rumble'. The designer/manufacturer had obviously known a thing or two!

Theatre background

Well then, who was Max Byer? Here I turn to the information assembled for me by Harry Mauger.

According to Max's daughter Patricia Dryden (nee Byer), Maxwell Theodore Byer was born at Castlemaine, Victoria in 1914. As a young man, he trained as a theatre projectionist but later gravitated to technicalities, gaining considerable expertise in converting early 'silent' and sound-on-disc projectors to sound-on-film.

Presumably realising that this could only ever be an interim occupation, Max noted that there was a steady demand for acetate disc recording blanks — this at a time before the adoption of magnetic tape technology. Accordingly, in the 1930's, he set up a small plant to manufacture acetate blanks at the rear of a factory at 8 Dorcas Street, South Melbourne. The enterprise was registered as Broadcast Recording Supplies (BRS).

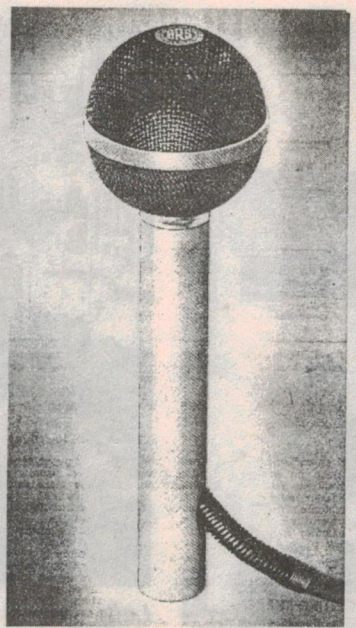


Fig.4: In the era before modern dynamic and electret microphones, Byer Industries offered hobbyists this impressive looking 'sound cell' crystal type.



Fig.5: Announced in R&H for September 1951, the Byer AT-12 'Magnofilm' tape adaptor made it possible for hobbyists to record and play tape at 7-1/2 or 15ips using a turntable to provide tape drive, plus a supplementary tape bias/preamp unit.

When wartime conditions created a shortage of blank discs, the role of BRS became critical. Used discs were recycled by stripping the acetate from the aluminium and, when aluminium itself became scarce, steel and even glass were used as a base.

Factory foreman

Prompted by Harry Meager, Jack Richardson, Byer's one-time factory foreman, jotted down a dozen-odd pages of handwritten notes which came as an eye-opener to a mere Sydneysider whose contact with BRS had mainly to do with hobby-level recording.

Recalling Byer's disc coating process, Jack explained that the discs were loaded in rows onto six rotating spindles, radiating spider-like from a central vertical column. Supported below them was a special tank containing the lacquer. With the discs rotating, the tank was raised slowly just far enough to allow the lacquer to partially submerge both sides of one row of discs at a time, leaving uncoated an area around the spindle sufficient to accommodate the label. The lacquer tank was then lowered, leaving the coated discs rotating on the 'spider' to drip and dry while the next row of discs was readied for their partial immersion.

Byer had two such six-armed spiders. Needless to say, it was essential that the process be carried out under dust-free conditions.

12-inch and 16-inch metal discs were normally sanded prior to coating, to ensure that the lacquer would adhere. Then they were heated under a half-ton pressure to ensure flatness.

Jack Richardson said that Max took up the production of disc recorders as much as anything to support the demand for his blank discs. From the first basic portable model mentioned earlier, successive variants provided a two-speed facility

with microgroove, another for either inside-out or outside-in recording, a special record-only head with harder suspension rubbers, and a supplementary purpose-built amplifier to provide for PA etc., as well as amateur recording.

The play/record heads were assembled in-house, as were moving coil pickups for use with recording lathes involving professional 12-inch and 16-inch turntables. For the latter, Byer Industries also produced their own overhead traverse mechanism.

Other products

Other items which came out of the factory included microphone stands, both single and boom types, ball type microphones and ribbon type mics for AWA — virtually RCA's well known 44BX under licence.

Additional to the above, in *R&H* for April 1951, I noted a full page advertisement for a B-46-D 'Audio Cell' crystal microphone — non-directional, 40-8000Hz and moisture proof, obviously intended to 'look the part' for amateur use (Fig.4).

It is clear from Jack Richardson's letter that Byer Industries were also involved in making synchronous drive motors, initially for their own portable disc player/recorders and later for wire recorders manufactured by Pyrox. Max Byer, I gather, was something of a specialist in motors.



Factory foreman Jack Richardson checks out a couple of Byer 77 recorders, as supplied to the PMG and ABC for sound coverage of the Melbourne Olympic Games.

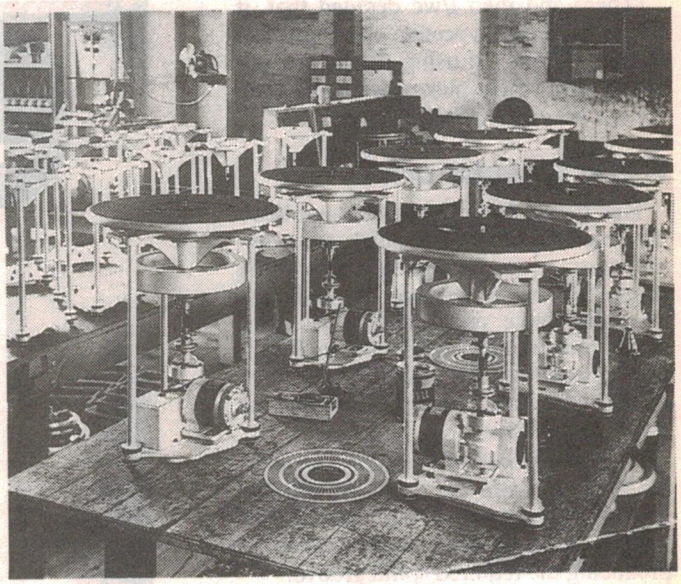
Adding to the picture, Jack mentions E-12in and E-16in professional turntables with 2-speed gate change and external drive; the T19, a 16-in turntable with internal drive and cam speed change, originally 2-speed later 3-speed; the T33, a 16-in turntable driven through a gearbox; and the T12, 2-speed involving taper on centre spindle.

At the height of this activity, someone developed a wow and flutter meter and, says Jack, "it was applied at Byers to just about anything that turned".

PMG inspectors used it to double-check turntables supplied for use by the ABC. "Later they installed a direct line from Byers to the PMG offices in Jolimont, so that inspectors could check turntables without having to travel to Jolimont. To provide the requisite test signal they used a 3000Hz test disc" — itself a potential, if marginal source of wow!

By 1946, Max Byer had taken over a larger section of the Dorcas Street premises, allowing him to cast in-house up to 16-inch transcription turntables for the broadcast industry. In 1947, further





Left: Quality control at Byer Industries. Factory foreman Jack Richardson checks a batch of motors and other components being readied for final assembly. Right: In sharp contrast to the 'Junior' portable recorder, a batch of multi-speed professional turntables are seen undergoing a mandatory two-hour test run for heat rise above ambient.

expansion saw occupation of the whole factory and incorporation as Byer Industries Pty Ltd.

When stereo sound appeared on the horizon, Max Byer was one of those who convinced Melbourne radio stations 3XY and 3UZ to cooperate in a public demonstration. Each broadcast one side of the stereo signal and the public were invited to listen to the result, with two radios in the same room tuned to the respective stations.

Byer too modest!

In effect, Jack Richardson's jottings presented what is now commonly called 'the big picture' — but 40 or more years too late! Max Byer and staff had been so pre-occupied at the time in developing a succession of specialist products, that they omitted to publicise them to the degree they deserved.

At *Radio & Hobbies* we knew about their portable disc recorders and associated products, but I have no recollection of insistent press releases or advertisements to publicise the professional products mentioned by Jack Richardson. To *R&H* readers, Byer Industries was seen as a modest Melbourne company involved mainly in portable disc recorders and associated what-nots!

For me, at a personal level, practical experience with amateur disc recording fell short of earlier expectations, anyway. Amateur performers proved more than ever prone to nerves and presentation lapses when they were being recorded. And technically, there was always the risk of an overcut or an accident with the swarf, leading to the situation: "Your performance was okay but there's a fault in the disc. Sorry, but we'll have to do it all again."

Faced with such situations, my enthusiasm for amateur disc recording waned markedly. Editor John Moyle fared rather better, as is evident from articles published in the early 1950's.

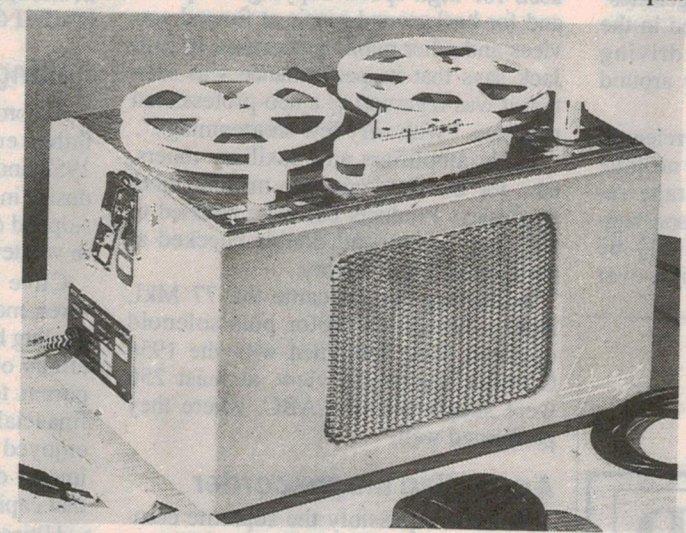
John's involvement with the technology peaked when he acquired a later version of the Byer recorder, able to produce a direct cut recording in the LP format: microgroove and 33rpm.

As a connoisseur of classical music, John saw it as an opportunity to record ABC concert broadcasts, particularly those carried by their 'experimental' FM outlet. There was no problem with temperamental artists, and the performances had already been 'miked' and monitored to broadcast standards.

John generally managed to obtain blanks and stylii which would steer the swarf well clear of the uncut area. In any case, with the incoming signal under control, he was able to concentrate on the cut — camel-hair brush in hand, to nudge the swarf aside if the need arose.

Disc versus tape!

John Moyle was nothing if not enthusiastic about his home-made microgroove transcriptions, which he claimed compared well with the original broadcast and lost little by comparison with commercial pressings — this based on the immature standards of the day. He was certainly not slow to report on his handiwork, which probably reinforced the public do-it-yourself concept of Byer Industries! (Ref: 'You Can Make Records At Home' by John Moyle, *R&H* December 1950 and January 1951.)



The Byer 'domestic' tape recorder model 55, their first self contained portable and arguably the first such Australian made unit. It was promoted mainly by the Myer chain.

About the same time magnetic tape and tape equipment made its tentative appearance on the local market, although it was the subject, initially, of much confusion about standards. There were four or more traverse speeds (30, 15, 7.5 and 3.75 inches/second), and the tape was variously spooled oxide-in or oxide-out.

The magnetic track(s) could occupy the full 1/4in width of the tape or be 'half-track' or 'quarter-track' and/or accommodate mono in various configurations — or conceivably, stereo.

The physical stiffness and flatness of tape also tended to vary with the brand, batch or age, which sparked endless arguments about tape and takeup methods — arguments about which we probably copped more than our fair share in the editorial office of *R&H*. As it happened, I tended to be exposed predominantly to the Pyrox/AWA 'Magictape' recorder, which was utilitarian rather than trendy. But it convinced me that tape technology held the ultimate answer for both professionals and amateurs alike.

Max Byer's initial response to the appearance of tape was not to produce a self-contained tape recorder/player. Instead, with simplicity and economy in mind, he devised the unique BRS 'Magnofilm' tape adaptor, further reinforcing Byer's public image as a supplier to hobbyists.

Byer tape adaptor

Diecast and neatly finished (Fig.5), it was intended to be used in conjunction with his own disc cutter/player or any other phono turntable known to have adequate power and to be free from wow and flutter. It was designed to straddle the turntable, with its rotatable shaft gripping the turntable spindle and two fixed legs resting on the motor board.

The turntable spindle would provide drive for the tape capstan, as well as powering the take-up spool via a slipping 'clutch' involving gravity and a felt washer. The deck carried its own record/play head with a bias winding, for connection to an external preamplifier unit. Erasure required the use of a separate hand-held 50Hz bulk eraser.

The adapter was less costly than a separate self-contained deck, and produced excellent recordings. But it required a fair amount of fiddling to set up, rewind, erase and load the tape. John Moyle acknowledged its potential at the time but, to him, it provided another example of the 'messiness' that seemed to characterise the new medium. "Falls off the reel" was his oft repeated grouch about tape!

John didn't mind in the least being regarded as a 'disc' man. But, then again, he didn't live long enough to experience the 'tidiness' of the compact tape cassette, and its dramatic transformation from an inexpensive handyman system to a rival for top-quality stereo microgroove discs.

Here again, Jack Richardson's notes add depth to our personal recollections of that very early phase. Readying for the tape era and looking well beyond the humble tape adaptor, Byers engaged their own pattern maker, set up an in-house

foundry for castings and prepared to do their own silk screening.

They put a lot of work into the production of tape heads in-house — some of which used .005" mumetal laminations, stacked and glued into blocks, heat treated and machined into shape. Special attention was given to head contour and positioning to optimise tape contact, and also to spooling motors controlled by DC to apply tension. At one stage, Byer pole pieces found a ready market in Canada, by reason of their superior performance.

First local recorder?

Aside from the tape adaptor, Byers also developed and released the first Australian continuous tape player. Jack still has painful memories of a tape loop containing the 'Happy Little Vegemites' advertising ditty, which was tested in the factory for weeks on end — driving everyone within earshot slowly around the bend!

It would appear that, having released his tape adaptor, Max Byer lost no time in developing self-contained tape recorders, such that Jack Richardson suggests that Max could reasonably be credited with producing the first-ever Australian-made unit.

The Byer 55, he says, was 'developed in a hurry' to keep things moving while they proceeded with the design of the more elaborate Byer 66.

Employing a single motor and mechanical function control, the 55 attracted favourable comment from the CSIRO for its simplicity of operation. Max Byer was so delighted that, uncharacteristically, he hired an aerial signwriter to write 'BYER 55' in the sky over Melbourne.

Seen as a 'domestic' recorder, the 55 was reasonably successful in its own right although admittedly — says Jack — it was "a bit of a nightmare" to service.

The Byer 66 was intended for the more demanding commercial market, and avoided the use of pressure pads and complex wrap-arounds for the tape. Well ahead of other portables, it was typically used for high-speed copying of speech and for background music at funeral services and other public gatherings. In fact, Jack says that its performance was such that it was regarded as a neo-professional machine, "with very few shortcomings".

Basic amplifiers and auxiliary tuners, etc., for the Byer 66 were manufactured by Zephyr Products but were married to the tape system and double-checked at the Dorcas Street factory.

Following the 66 came the 77 MkI, Byer's first three-motor plus solenoid operated deck. Designed with the 1956 Olympic Games in view, at least 250 were supplied to the ABC, where they performed well.

Australian Magnecorder

What was possibly the supreme compliment to Max Byer came in *R&H* in June 1951, when it was announced that Byer Industries Pty Ltd had been granted exclusive manufacturing rights of the American 'Magnecorder' for the Sterling market.

The announcement continued: *the Magnecorder... is used more extensively in the United States than any other (professional) recorder... and promises to prove extremely popular with Australian radio and electrical engineers... It is understood that the first batch is already off the assembly line.*

For the remainder of the Byer story, I am indebted mainly to Clive Sloss — who some may subsequently remember as a sales executive with Simon Gray Pty Ltd, the Melbourne hifi equipment distributor (Leak, Wharfedale, Ortofon, etc).

Early in his career, Clive had gained experience in broadcasting as a technician with stations 3AK, 3XY and 3UZ. In the early 1960's, he applied for and gained a position with Byer Industries as Technical Sales Manager. His initial assignment was to promote the new Mark II versions of the Byer 66 and 77 reel-to-reel recorders.

I quote: "Accepting the position was a sheer delight. Max was a perfectionist and a great person; the equipment was well constructed and the technology was up to date at the time. Tripping around Australia soon became my vocation."

Clive could rightly claim that Byer Industries had a good reputation for their acetate discs, accessories including the RCA/AWA ribbon microphone, disc cutters and professional turntables (including those supplied to New Zealand). There was the model 55 portable domestic tape recorder, model 66 rated as the best of the portables, the 77 and the Byer-built PTH Magnecorder — for many years the 'workhorse' of the broadcasting industry. And now, the Mark II 66 and 77.

Failing health

According to Max Byer's daughter, her father encountered health problems in 1958 and 'retired' from the recording industry in 1958, although "he never really stopped creating and becoming engrossed in whatever he project he took up".

Clive Sloss says that for a period, a three-man management committee (including himself) looked after the business affairs of Byer Industries. It became apparent to them that the Company was financially marginal, in that while Byer enjoyed some protection in the way of import duties, such was the competition that capital would always be a problem.

Ultimately, Byers was taken over by the Rola company of Richmond, who retained the factory at Dorcas Street but moved the Administration and Sales departments to their own head office. Later, Rola itself was taken over by Plessey, who were then swallowed by Philips. In the process Byer Industries virtually disappeared as an entity.

Clive says that he lost personal contact with Max Byer, who apparently established a motel in Holbrook, NSW "which still bears the Byer name and logo". Max subsequently moved to Adelaide.

His daughter Patricia simply records that "after numerous business ventures, he eventually retired to the Mornington Peninsula in the early 1980's. He passed away in January 1985".

To round off the biography, I can do no better than quote from Clive Sloss' summary: "Byer Industries was a small but efficient organisation, led by a great man who was dedicated in the main to broadcasting and allied industries". ❖

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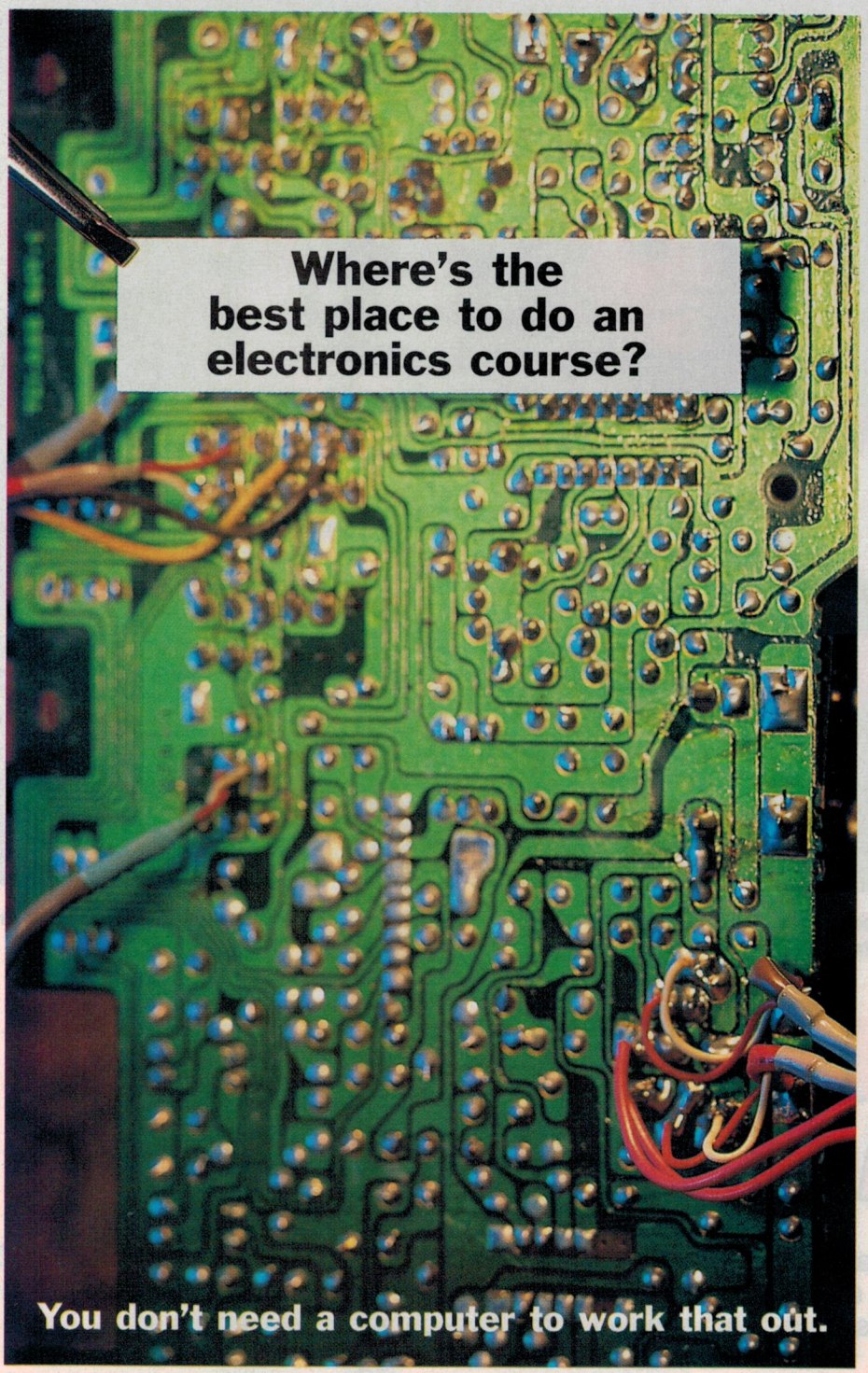
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Astronaut Eileen M. Collins, pilot, at the pilot's station during the 'hotfiring' procedure to clear a leaking thruster prior to rendezvous with Russia's Mir space station.

THE BEGINNING OF OUR SPACE FUTURE!

NASA's *Discovery* shuttle had a rendezvous with Russia's orbiting *Mir* space station on its STS-63 space mission earlier this year, an event heralded as the tangible beginning of a new era in international space cooperation. Here's an in-depth account of the mission and what it achieved.

by KATE DOOLAN

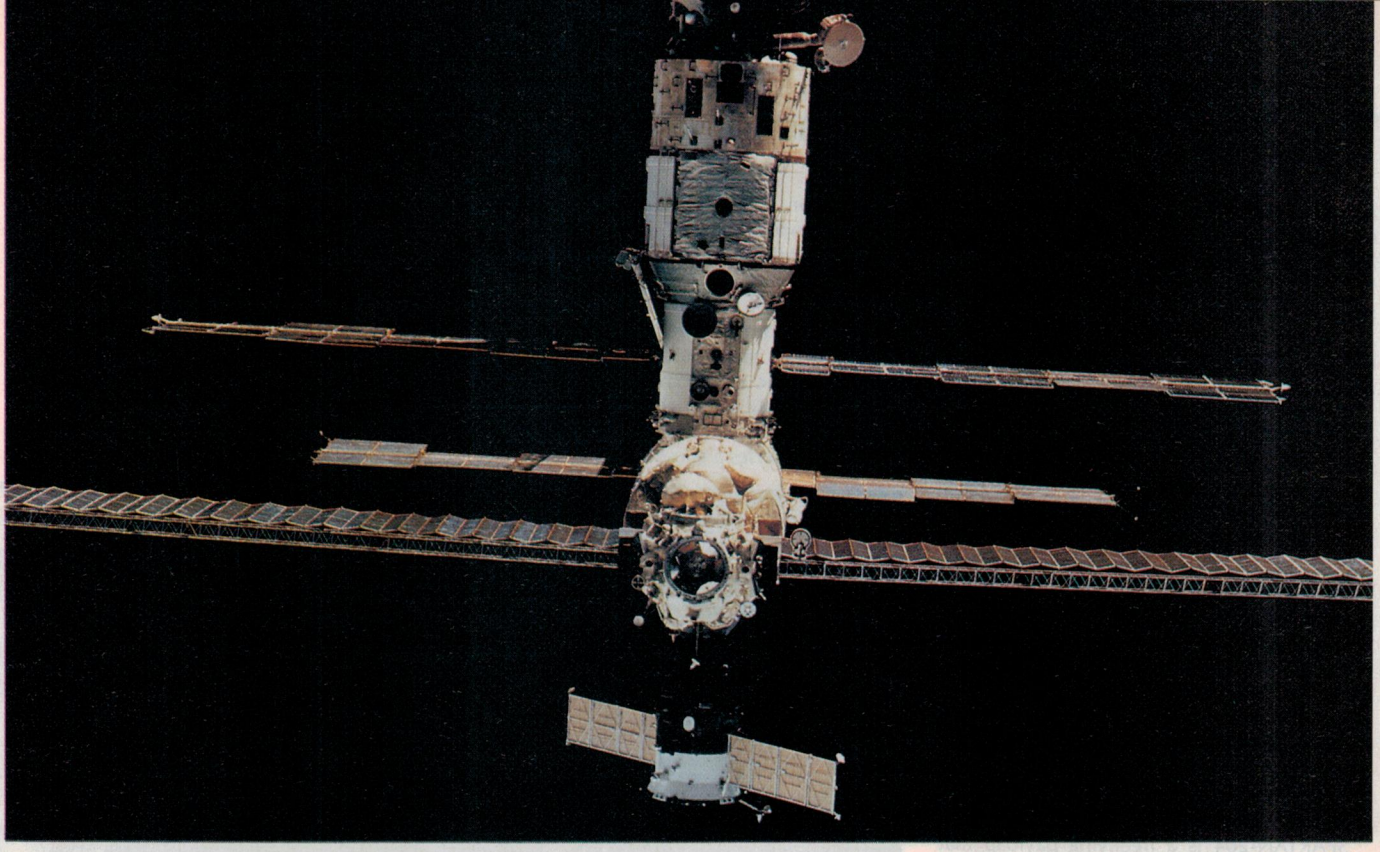
In October 1957, the Soviet Union launched the world's first orbiting spacecraft — Sputnik 1. It shocked the world, and in particular the United States of America which was accustomed in leading the world in all forms of science and technology. The events of October 1957 and its aftermath ignited the starting pistol for now what is known as the 'Space Race'.

During the next 35 years, both the United States and Soviet Union ran a very heated competition in space activities with the 'winner' receiving laurels in the form of praise from the rest of the world and propaganda triumphs, to overcome whatever other less-positive attributes that both societies had in abundance. Despite the Soviet Union being the first country to place the first satellite, animal, man and woman in space, the ultimate winner of the 'race' was the United States — which on 20 July 1969 landed two men, Neil Armstrong and Buzz Aldrin, on the surface of the Moon.

Despite vehement Soviet denials that they had never been in the Moon race, this was not correct. Several Soviet moon rockets exploded on the pad, and their cosmonauts had been undertaking similar training to the American astronauts who were then preparing to fly to the Moon.

Twenty years ago this July, there was a temporary truce called when both countries participated in the Apollo-Soyuz Test Project (ASTP), which saw their spacecraft rendezvous and dock in Earth orbit. This was followed by two days of crew exchanges, which included joint participation in scientific experiments and cultural activities.

Following the successful conclusion of ASTP, the United States expressed an interest in follow-up activities but these never occurred due to the worsening relations between the two



Russia's Mir space station during rendezvous operations with the Space Shuttle Discovery. Docked at the bottom of the Mir facility is a Soyuz vehicle.

countries. Another factor preventing these activities was the space shuttle program, which the National Aeronautics and Space Administration (NASA) was developing. Even though the space shuttle was under the auspices of the civilian space agency NASA, it was seen as a primarily military vehicle and therefore unsuited to cooperation with the Soviet Union.

Space stations

Following their failed attempts to land men on the Moon, the Soviet Union turned to keeping cosmonauts in Earth orbit for long duration stays, by launching a series of space stations that culminated in the launching of the *Mir* space station in March 1986.

Over the next 15 years, there was some space cooperation between the Soviet Union and United States, but the activities that were undertaken were seen to be low profile and of little interest to anyone. These activities included biomedical research, earth sciences and planetary exploration.

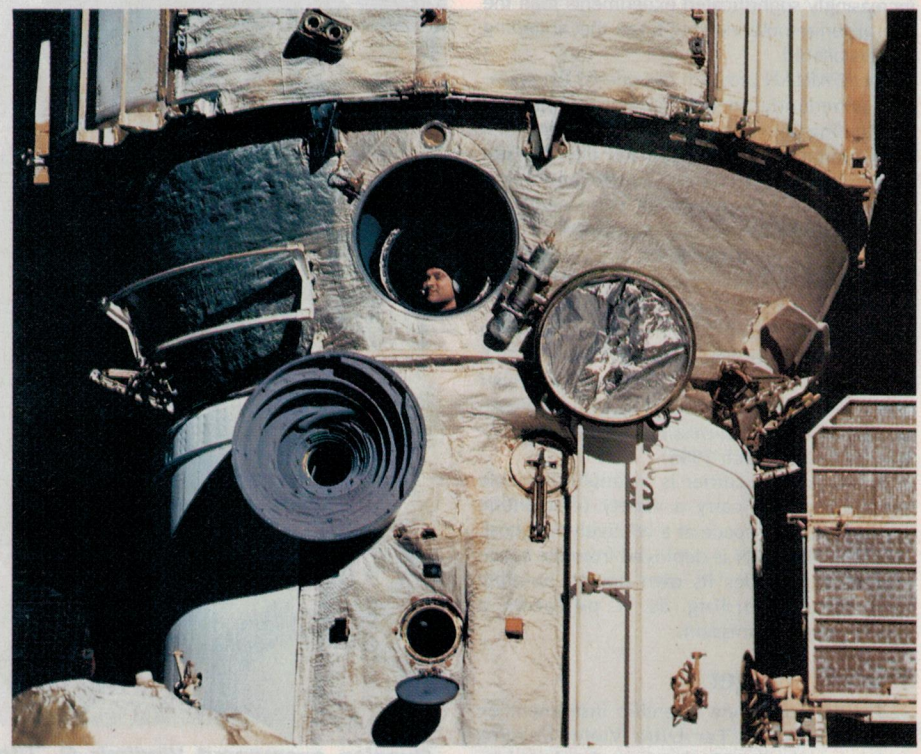
With the demise of the Soviet Union at the end of 1991, increased space cooperation with Russia became possible and during June 1992 in Moscow, then US President George Bush and Russian President Boris Yeltsin signed the 'Agreement Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes'. Included in the agreement was a consideration of a program in human space flight that included the following three phases:

- Flying Russian cosmonauts aboard the space shuttle
- Flying US astronauts aboard the *Mir* space station
- Rendezvous, docking and joint missions between *Mir* and the space shuttle.

An agreement on the above activities was signed by US Vice President Al Gore and Russian Prime Minister Viktor Chernomydrin in June 1993.

NASA and the Russian Space Agency (RSA) then started the detailed planning required to bring the space programs of the two former enemies together.

The first phase of the extended cooperation took place in February last year, when Russian cosmonaut Sergei Krikalev flew as part of the crew on STS-60. About the same time,



Cosmonaut Valeriy V. Polyakov, who boarded the Russian Mir space station on January 8, 1994, watches rendezvous operations from a convenient viewpoint.

The Beginning of our Space Future

American astronaut Norm Thagard left for Moscow to begin training as a crew member of the *Mir* 18 crew, which was scheduled for launch in the first quarter of 1995. Thagard was planned to spend up to four months aboard *Mir*, and he will be followed by astronaut Shannon Lucid who will spend up to six months aboard *Mir* next year.

It was also decided that another Russian cosmonaut, Vladimir Titov, would fly on the space shuttle on mission STS-63 which would be used as a practice in rendezvous with *Mir* in early 1995, in preparation for the upcoming rendezvous and docking flights.

SPARTAN-204

Apart from the activities with *Mir*, several other notable payload activities were planned to take place on STS-63. These include deployment of the Shuttle Pointed Autonomous Research Tool for Astronomy 204 (SPARTAN-204), the third flight of the commercially developed SPACEHAB module, the debut of a robot named Charlotte and a spacewalk designed to test human endurance in extreme temperatures.

SPARTAN-204 is a freeflying payload that studies interstellar gas and dust, and is the fourth in a series of astrophysics experiments that evolved from NASA's sounding-rocket programs of the 1960s and 1970s. The SPARTAN program was conceived during the late 1970s by NASA's Goddard Space Flight Centre in Greenbelt, Maryland and the US Naval Research Laboratory in Washington DC, to take advantage of the opportunities offered by the space shuttle to provide more viewing time for increasingly sophisticated experiments than the five or ten-minute viewing times that sounding rockets offered.

The SPARTAN program has offered the scientific community an additional capability for conducting investigations in space, between that offered by small payloads that are not deployed by the space shuttle and large payloads that remain in orbit permanently. In June 1985, the first SPARTAN payload successfully carried an X-ray telescope aboard the space shuttle *Discovery* on flight STS-51G. Another SPARTAN carrier, SPARTAN-Halley was aboard mission STS-51L when the space shuttle *Challenger* exploded soon after launch in January 1986. In April 1993 and September 1994, SPARTAN-201 was successfully flown aboard *Discovery* on missions STS-56 and STS-64 (see *EA* for March 1995).

The SPARTAN carrier is a simple, reusable vehicle that can carry a variety of scientific instruments into space at a relatively low cost. After the SPARTAN is deployed from the space shuttle, it provides its own power, pointing and data recording as it performs a preprogrammed mission.

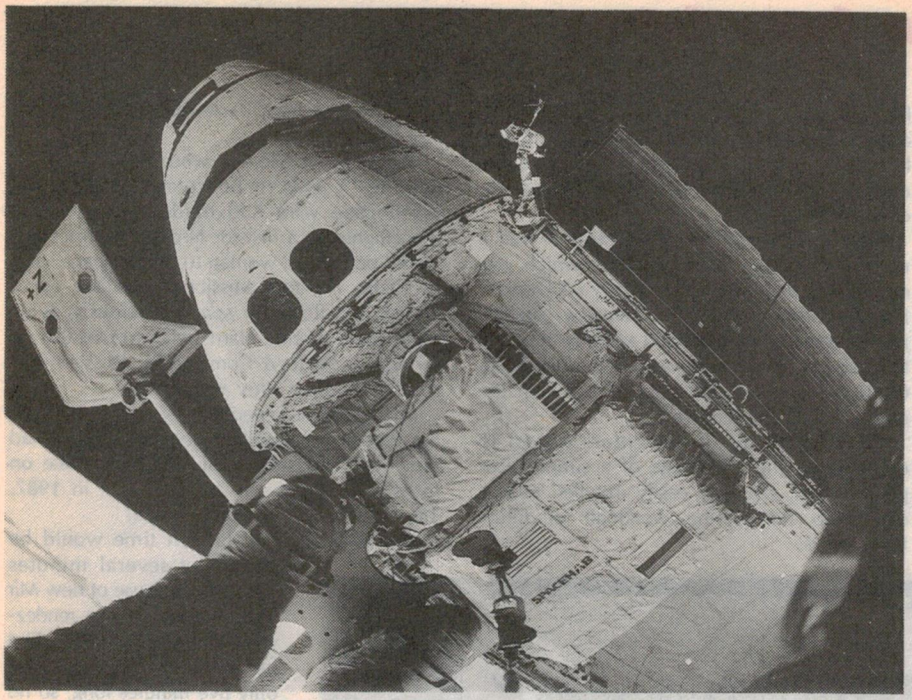
Far-UV imager

There is only one scientific instrument on SPARTAN-204: a Far Ultra Violet Imaging Spectrograph (FUVIS) that was developed by the US Naval Research Laboratory. The FUVIS is used to determine the temperature, density, composition, spatial distribution and other physical properties of the interstellar gas and dust, in our Milky Way galaxy and other neighbouring galaxies as well as taking spectral measurements of the environment around the space shuttle orbiter. The FUVIS is unique in that it observes the far ultraviolet region of the electromagnetic spectrum and has been optimised to study diffuse sources of radiation rather than point sources such as stars.

FUVIS comprises a telescope mirror, entrance slits, a concave grating and a microchannel-intensified electrographic camera housed in a canister on the SPARTAN service module. The camera is equipped with a CaF2 Schmidt corrector for transmitting wavelengths from 200 to 123nm (nanometres) and a windowless annular aperture for wavelengths as low as 97nm. The Schmidt corrector allows the camera to detect fainter features that could be obscured by interference from a bright airglow line caused by atomic hydrogen in the atmosphere.



Russian cosmonaut Vladimir G. Titov, mission specialist, handles vials of samples for the Commercial Generic Bioprocessing Apparatus experiment in SPACEHAB 3 module, onboard the Earth orbiting Shuttle Discovery.



This photograph of the Space Shuttle Discovery's forward section and forward cargo bay, was taken by a crew member during a space walk. The SPACEHAB 3 and Ku-band antenna are visible.

Photographs taken by a 35mm camera with a 635mm lens are used to verify the pointing of the spacecraft at celestial targets. The aspect camera is housed on the instrument canister with FUVIS, and takes photographs simultaneously with the electrographic camera.

Researchers plan to use the far-UV measurements with measurements from other wavelengths to obtain a better understanding of the makeup of interstellar material, which is the matter from which stars and planets are formed. The spectrograph measures the ultraviolet radiation that is scattered by interstellar dust particles, which should reveal their composition and physical properties. It can also observe emissions from the gaseous phase of planetary nebulae, stellar wind bubbles, ionised hydrogen regions, hot interstellar gas and the remnants of supernovas to gather information on the composition, temperature and spatial distribution of gas.

For the celestial observations of natural sources of ultraviolet radiation, FUVIS is aimed at diffuse nebulae, the galactic diffuse far-UV background and comets. Celestial targets are selected from a list of priority objects, based on launch date and orbit constraints of the space shuttle. Targets that are not listed may also be selected.

The slit-type imaging spectrograph uses a Cesium Iodide photocathode, very fast f/1.0 optics and a microchannel plate that amplifies the images to give the instrument the highest possible sensitivity to diffuse objects in the far-UV, in the 97 to 200nm range. FUVIS complements the other far-UV spectrographs currently in use on NASA astronomy missions, such as the Hubble Space Telescope and the Hopkins Ultraviolet Telescope which flew on the ASTRO-2 space shuttle flight STS 67 during March 1995.

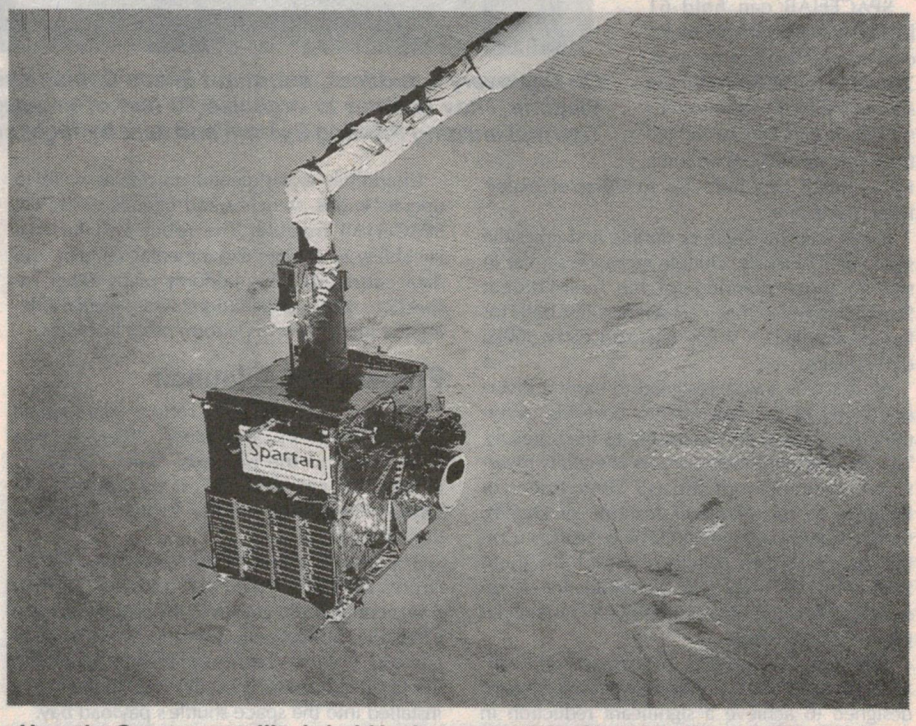
Measuring the glow

The planned first phase of the SPARTAN-204 mission was a 4.5-hour study of the surface glow produced by the space shuttle orbiter itself, and spectral emissions from the main engine plumes. Using the shuttle's Remote Manipulator System (RMS) arm, an astronaut would remove SPARTAN from the payload bay and point the 1210kg satellite at the orbiter so the imaging spectrograph could observe the glow on the surface of the orbiter's tail and the firing of the Orbital Manoeuvring System (OMS) rockets. A low- light-level television camera mounted on the freeflyer and aligned with the imaging spectrograph enables the RMS operator on the orbiter's aft flight deck to position the instrument.

The data from these observations will help explain the cause of surface glow, which was discovered only recently. The glow could be a source of interference with sensitive astronomical instruments. The US Department of Defence is interested in the results of these studies, as it may be possible to use surface glow and emissions from rocket engine plumes to detect and track ballistic missiles as well as orbiting vehicles. The far-UV wavelength may be more useful for these purposes than visible and infrared wavelengths.

The freeflying portion of the SPARTAN-204 mission was scheduled to begin on flight day five after the *Mir* rendezvous, if the space shuttle orbiter had sufficient propellant left. The crew would use the RMS arm to remove SPARTAN from its support structure in the payload bay and release it into space. The orbiter would remain close enough to verify that the satellite's attitude control system was functioning correctly. The orbiter would then slowly move away from SPARTAN until it trailed by a distance of 150km.

During the freeflight phase, SPARTAN would operate autonomously for approximately 40 hours. On flight day seven, the orbiter would fly back to the SPARTAN and once it was only 10m from the satellite, the RMS arm would be is used to grapple and place it back in the payload bay for the return journey to Earth.



Here the Spartan satellite is held in the grasp of the Shuttle's Remote Manipulator System arm. The Russian cosmonaut Vladimir G. Titov was controlling the RMS from Discovery's aft flight deck.

The Beginning of our Space Future

SPACEHAB module

Early in the space shuttle program, it became evident that the space shuttle orbiter's mid deck was the best place to conduct crew-tended experiments in space. Each space orbiter has 42 mid deck lockers, but most are used for the stowing of personal crew gear, leaving only seven or eight lockers available for scientific experiments.

To solve this dilemma, the SPACEHAB module was developed by SPACEHAB Incorporated, which also operates it. NASA agreed to lease two thirds of the module's space for its first six flights, which are expected to occur twice yearly. The first flight of SPACEHAB took place on STS-57 in June 1993, while the second one was STS-60 in February 1994.

The SPACEHAB module is three metres long and four metres wide, with an area of 31m^3. It is located in the forward end of the orbiter's payload bay. The astronauts enter the module through a modified Spacelab tunnel adaptor. SPACEHAB can accommodate two crew members on a continuous basis, but additional crew members can work in the module for brief periods of time. Power, command, data services, vacuum, cooling and other utilities are supplied by the orbiter crew cabin and payload bay resources.

SPACEHAB can hold 61 lockers or experiment racks, or a combination of the two. The lockers are equivalent in size to those on the orbiter's mid deck and can be moved from one location to another. Each locker can hold up to 60kg of experiment hardware.

A rack can be single or double and takes the space of 10 lockers. Double racks are similar in size to those planned for the International Space Station, so they can serve as test beds for future planning. A single rack can carry 300kg of hardware.

SPACEHAB 3 was designed to carry a diversified mix of 20 experiments, covering everything from materials processing to life sciences. The list of experiment sponsors is equally diversified, ranging from the US Department of Defence to the National Institute of Health. Many of the experiments have been flown on the space shuttle previously, and for them SPACEHAB 3's flight was a continuation of research to develop new or improved commercial products or processes.

One new feature incorporated into SPACEHAB 3 was a video switching system, designed to achieve a significant reduction in demands on the crew's time. Eight video cameras in the module are controlled from the ground instead of by the astronauts. SPACEHAB Inc. also improved the module's telemetry, to allow experimenters on the ground to tie directly into the system — enabling them to better monitor their experiments, and thus relieve the crew of this task.

Making its debut on SPACEHAB 3 was a robot named Charlotte. Charlotte, which was developed, designed and built by McDonnell Douglas Aerospace does not employ gantries, jointed arms or sophisticated systems. Roughly the size of a microwave oven when deployed, Charlotte is suspended on cables which are easy to install and remove.

With Charlotte, its inventors hoped to demonstrate the advantage of a simple, low power, rigid, safe and easily installed robotic device to relieve the workload of future flight crews.



On Discovery's middeck, astronaut Eileen Collins and cosmonaut Vladimir Titov attempt to organise 30 feet of messages from the Thermal Imaging Printing System and sent by flight controllers.

Charlotte's experimental objectives were to operate knobs, switches and buttons inside the SPACEHAB module. The robot also has the capability to change experimental samples and data cartridges, plus perform many other inspections and manipulation tasks — again freeing the flight crew to perform other activities.

Preparation & launch

Following *Discovery*'s return from space flight STS-64 in September 1994, it was flown back to the Kennedy Space Center in Florida. On arrival at KSC, it was taken to the Orbiter Processing Facility to begin preparations for STS-63.

The SPACEHAB 3 module was prepared for flight at the SPACEHAB facility at Port Canaveral and then taken to the Operations and Checkout building, as was the SPARTAN-204 payload. Both payloads were then transferred to the Orbiter Processing Facility, where they were installed into the space shuttle's payload bay.

On 4 January 1995, *Discovery* was moved to the Vehicle Assembly Building, where it was mated to its solid rocket boosters and external tank. Five days later, it was rolled out to Launch Pad 39B.

The crew of STS-63, who were named in June 1993, was to be commanded by Jim Wetherbee who had made two previous spaceflights. In a first for NASA, Eileen Collins would be the first woman to pilot a space shuttle flight. The four Mission Specialists, all of whom had flown in space previously, were Mike Foale, Bernie Harris who would also be serving as Payload Commander, Russian cosmonaut Vladimir Titov and Jan Voss.

In spaceflight experience, Vladimir Titov far outstripped his American colleagues as he had previously clocked up 367 days in space on three spaceflights. On his last flight in 1987, Titov had spent 365 days in space!

Discovery's actual launch time would be varied by several minutes each day, because of new *Mir* 'state vectors' for the rendezvous phase of the flight. The launch window would be only five minutes long, so no delays were possible before the window closed. The launch was actually delayed for 24 hours, because of problems in the shuttle's navigation system when a faulty unit had to be replaced.

Eventually *Discovery* was launched from KSC at 12:22am (local time) on 3 February 1995, lighting up the night skies for thousands of kilometres around KSC.

One problem that had no effect on the actual flight of *Discovery* was the amount of damage to the solid rocket boosters, after they splashed down in the Atlantic Ocean. High seas and rough winds severely damaged the boosters, and it's doubtful whether they can be used again. Major sections of the two boosters were torn loose and lost, while the forward section of the left booster snapped off — sinking a US$3 million piece of hardware. The final bill for the damage could reach nearly US$80 million, if the boosters have to be replaced.

Thruster leak

The flight into space was uneventful. But soon after reaching orbit, *Discovery* developed a leak, with one of its reaction control system jets spewing out highly corrosive nitrogen tetroxide. Although thruster leaks are a common occurrence, this leak was of concern to mission controllers because of the upcoming *Mir* rendezvous.

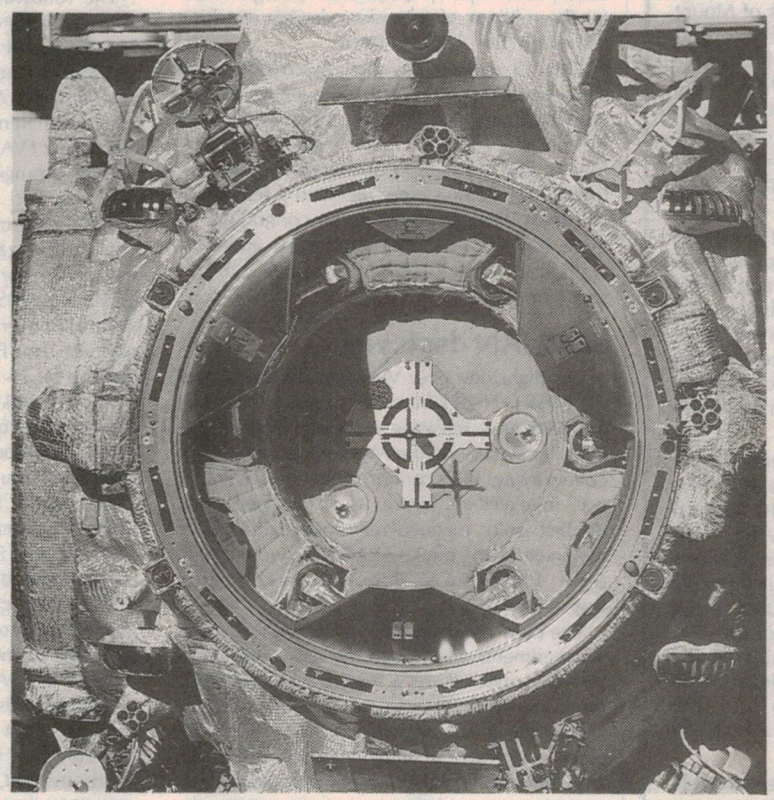
Flight rules for the mission stated that *Discovery* would need to have all of its aft firing thrusters operational, before it moved to within 300 metres of *Mir*. On past flights, leaks frequently cleared themselves once the jets were warmed by the Sun or thruster firings.

Mission controllers asked Jim Wetherbee to

position *Discovery* so that the Sun would shine on the top side of the vehicle for several hours, to help warm up the leaking thruster. Planning was then continued for the rendezvous with *Mir*.

Also on flight day one, Vladimir Titov and Jan Voss activated the SPACEHAB 3 module, beginning work on the 20 experiments aboard. *Discovery*'s RMS arm was also activated and a photographic survey of the orbiter's payload bay took place.

As a result of the exploration and use of space to date, man-made debris now circulates in a multitude of orbits about the Earth, and is posing a growing hazard to future space operations. Since the launch of Sputnik 1, more than 3200 launches have placed approximately 6500 satellites weighing two million kilograms in Earth orbit. While these objects are catalogued by the Space Surveillance Network operated by the United States Space Command (USSPACECOM), only 6% represent functional satellites — with the rest being considered as debris. Additionally, USSPACECOM only tracks objects larger than 10cm in diameter. However, history has proven that smaller objects have caused and are continuing to cause considerable damage to spacecraft.



This photograph of the Mir docking area was taken during close proximity operations.

One of the first things that the crew of STS-63 did on flight day two was to deploy the Orbital Debris and Radar Calibration Spheres (ODERACS), from a canister in the payload bay. This experiment consists of three metal spheres and three strands of wire, all of varying sizes and composition, which will be used to 'fine tune' ground radars and optics around the world that track space debris. The spheres and wires will remain in orbit for periods ranging from 20 to 280 days.

Continuing in efforts to stop the leaking thruster, Jim Wetherbee and Eileen Collins closed and reopened the manifold of the leaky thruster several times. The same procedure was used earlier to clear a leak in another thruster on the nose of the orbiter, but this procedure was not as successful the second time around.

With other crew members continuing with the SPACEHAB experiments, Mike Foale and Vladimir Titov conducted a study to observe how materials burn in a weightless environment. The Solid Surface Combustion experiment examined how Plexiglas burnt.

Meanwhile flight control teams at the Johnson Space Centre in Houston, Texas and at Kaliningrad (outside of Moscow) in Russia were working to refine plans for the upcoming rendezvous. The concern of the Russians was that *Discovery*'s leaky thruster could damage critical optical sensors on the *Soyuz* spacecraft attached to *Mir*. If the leaking thruster could not be shut off, *Discovery* would only be able to fly within 1000m of *Mir* instead of the planned 10m.

Following all-night negotiations between NASA and the Russian Space Agency, *Discovery* was given permission to close to within 10m of *Mir* if the leaky thruster was completely shut down — which it was.

Rendezvous time

The rendezvous sequence of STS-63 actually began nine hours into the flight, when a reaction control system jet adjusted the rate at which *Discovery* would close in on *Mir*. Over the next two days, additional burns gradually bought *Discovery* closer to *Mir*'s 292km-high orbit, until it was within 15km of the space station.

Once *Discovery* had passed to within 1.5km of *Mir*, Jim Wetherbee took manual control of the orbiter and flew the shuttle from the aft flight deck controls as *Discovery* circled up to intersect the velocity vector of *Mir*. The velocity vector, known as the 'V-Bar', is an imaginary line drawn along *Mir*'s direction of travel. Once *Discovery* reached within 150m of *Mir*, Wetherbee stopped the orbiter until Russian flight controllers gave permission for the rendezvous to proceed.

As *Discovery* was closing in on *Mir*, the Trajectory Control Sensor (a laser ranging device mounted in the payload bay) supplemented the navigation information by supplying data on the orbiter's range, range rate, elevation and azimuth until *Discovery* was within 30m of *Mir*. For the final approach, the crew used a handheld laser ranging and range rate measurement device, which had been used on previous missions.

Once permission was secured for the rendezvous to proceed, Jim Wetherbee flew *Discovery* from 100m to a point about 10m from *Mir*, to align with the space station's docking module in rehearsal of the docking approach planned for the upcoming docking between Atlantis and *Mir* on STS-71.

To assist with the alignment, Wetherbee watched the approach from a centreline television camera mounted in the upper window of the SPACEHAB 3 module. As *Discovery* passed to within 70m of *Mir*, cosmonaut Vladimir Titov contacted his colleagues aboard *Mir* by using a VHF radio system.

Following the final approach, Wetherbee parked *Discovery* 10m in front of *Mir* — whilst both spacecraft were travelling at 28,000 kilometres per hour. During the 13 minutes in which the rendezvous was performed, Titov and his STS-63 colleagues waved at the cheering and laughing *Mir* crew as well as talking with them. Jim Wetherbee told the *Mir* crew of Alexandr Viktorenko, Valery Polyakov and Yelena Kondakova that "We are bringing our spaceships closer together. We are bringing our nations closer together".

In reply, Viktorenko stated that the nine space travellers "were in the greatest profession that

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NOTES & ERRATA

Experimenting With Electronics (April 1995): In our July issue (page 94), we gave the parts lists and information on the suppliers for the COB devices, which had been accidentally omitted from the April EWE. However we have since been advised that Alpine Technologies of Mount Waverley is not an agent for the COB devices — only the DIY Electronics microprocessor kits. The COB kits are available in Victoria from Laurie Cook, phone (058) 62 1915, and in NSW individual sound generator COBs are available from Oatley Electronics, phone (02) 579 4985.

EPROM Programmer (Sept/Oct 1993): Some builders seem to have experienced faulty operation, apparently due to noise on the 5V supply lines inside the programmer while reading or programming. The noise in turn seems to be caused by the LED currents interacting with the regulation of some power transformers.

If you are experiencing problems, it will be easy to check if this is the cause — assuming you have used IC sockets. Try temporarily removing U8 (74HC245), which will disable the LEDs without affecting the programmer's ability to read or write EPROMs. If the programmer now seems to operate correctly, the remedy is to replace U8 but increase the value of LED series resistors (R37-R44) from 390 ohms to 1.5k. The LEDs will now be dimmer, but should still be bright enough to see.

Shoestring Stereo Amplifier (December 1994): The schematic diagram on page 59 has the pin numbers reversed on IC1a. The inverting (-ve) input of the TL072 should be labelled as pin 2, while the non-inverting input (+ve) should be shown as pin 3.

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READER INFO NO. 8

The Beginning of our Space Future

God could give anyone and it is almost like a fairytale, too good to be true".

The two crews also sighted each other with television cameras. *Mir* sent back spectacular images as *Discovery* zipped past, and *Discovery* took equally spectacular footage of *Mir* for the millions of television viewers watching the action 'live' back on Earth.

After 13 eventful minutes, *Discovery* pulled away from *Mir*, with Wetherbee telling the *Mir* crew that next time the two crews would be a lot closer — in each other's spacecraft. Following the completion of the rendezvous activities, the STS-63 crew received a telephone call from President Bill Clinton congratulating them for "showing that Americans and Russians can work together, whether it be in space or on Earth".

SPARTAN deployed

On flight day five, Vladimir Titov deployed the SPARTAN-204 from the payload bay using the RMS arm, releasing it for two days of free flying activities. As Jim Wetherbee pulled *Discovery* away, Titov confirmed that the SPARTAN was in excellent health as it had performed its first solo manoeuvres impeccably. Over the next two days, SPARTAN would drift some 150km away from *Discovery* until it was recovered.

The crew continued to work with SPACEHAB 3 experiments all through the day, until it was time to knock off. As a reward for good work, the crew were given an extra hour of sleep before the hectic activities that were to take place over the next couple of days. Before the crew did turn in, Mission Control faxed to them several pictures of *Discovery* as it was seen by the *Mir* cosmonauts when approaching the Russian space station.

In preparation for their upcoming spacewalk, Mike Foale and Bernie Harris — with assistance from Vladimir Titov — spent the following morning unstowing and evaluating the spacesuits that would be used for a five hour extravehicular activity (EVA, or 'spacewalk'). The EVA would be used to test new thermal garments added to the spacesuits, and also to evaluate the astronaut's ability to manoeuvre large objects in zero gravity. In this case, the SPARTAN-204 satellite would be used as the demonstration testbed.

Jim Wetherbee and Eileen Collins also took time out to check the flight control systems that *Discovery* would need for landing. The flight deck displays and controls, navigation aids and the orbiter's aerosurfaces were tested and found to be in excellent shape.

Attending to the public relations duties of the flight, the whole crew was interviewed for the 'NBC Today Show' and Eileen Collins also used the opportunity to talk to her former chemistry teacher and current students at her old high school in upstate New York.

Shortly after those activities, *Discovery* commander Jim Wetherbee and *Mir* commander Alexandr Viktorenko spoke to each other, through interpreters at the Mission Control centres at Houston and Kaliningrad. The two commanders complimented each other on their spacecraft, and said that they were looking forward to meeting each other back on Earth.

Checking underwear...

The following day, Wetherbee and Collins flew *Discovery* back to the vicinity of the SPARTAN-204 and using the RMS arm Jan Voss recaptured the satellite, placing it into the payload bay. Almost immediately after, Mike Foale and Bernie Harris ventured outside to begin their EVA.

After arranging their tools in the payload bay, the two astronauts mounted the RMS arm for a thermal evaluation of changes in the new undergarments worn inside their spacesuits. For that test, Vladimir Titov positioned the RMS arm so that the two astronauts were high over and away from the heat of the payload bay. Foale and Harris stayed in that position for 15 minutes, subjectively rating their comfort levels whilst temperature sensors in their gloves collected data that will be compared to temperatures taken of the space environment around them.

During the second part of the spacewalk, Bernie Harris conducted a mass handling exercise with the SPARTAN to gain experience in moving large objects around in orbit. Although a large object will weigh nothing in zero gravity, the astronauts still have to contend with the mass of the object, which sometimes can prove to be very difficult.

Whilst Harris was finishing this portion of the exercise, both astronauts started to complain that they were having difficulties in feeling their hands and feet, because of the - 87°C temperatures. After hearing of this, Mission Control cancelled the last hour of the spacewalk, ordering the astronauts to stow their tools and return to the inside of the orbiter after a four hour and 39 minute spacewalk.

On the last full day of the flight, the crew participated in the traditional inflight press conference and began to deactivate the SPACEHAB 3 module and its experiments. During this time, *Mir* performed an on-orbit manoeuvre. STS-63 crew members reported that they could see the space station, which resembled a small flashing star some 1500km away from *Discovery*.

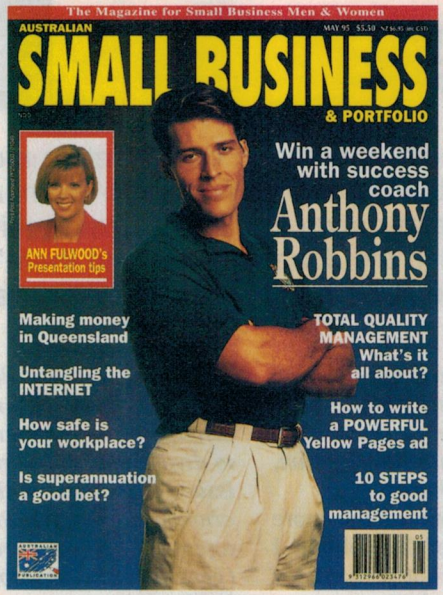
Early the next morning, *Discovery* landed at the Kennedy Space Centre in Florida after a flight of eight days and some four million kilometres. Live television coverage of the landing was transmitted to Mir Mission Control in Russia, and beamed up to the cosmonauts aboard *Mir*.

With the successful flight of *Discovery*, it can be argued that the long, expensive and sometimes bitter space race is finally over, and a new era of international cooperation has begun. This is now the future, for the world's two largest space powers.

In closing, the author wishes to thank Debbie Dodds of the Johnson Space Center, Kay Grinter of the Kennedy Space Center and Jenni Waghorn of Aerospace Education Australia for their assistance in the completion of this article. All photographs are by courtesy of NASA. ❖

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50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

August 1945

Paper by wire: 'The New York Times' during the San Francisco Conference achieved something unique in newspaper history — its 2am edition was available in San Francisco, about 3000 miles away, on the morning of issue.

The main pages were sent across the continent by wire and reprinted by facsimile process in San Francisco.

Each page required two plates. The wirephoto plant for the transmission was specially made, and is now being developed to carry a full page to each plate.

Distant programme heard: Mr Les Keast, Carlingford, well known for his work with our contemporary magazine *'Radio World'*, phoned us the other night to advise broadcast band DX'ers that he heard a programme from San Francisco, on shortwave on June 20, in which Bing Crosby sent special messages to listeners of the new AEF station WVTX, on Iwo Jima.

The frequency of this station is unknown here, at the time of writing.

Mr Gaven Kelly, while in Gympie recently, heard another AEF station, WVTM, signing off with a fair signal after a news relay from USA at 12.07am. WVTM was heard on 1300kc.

August 1970

Weather satellite: The first of the second generation weather satellites designed for operational use by the Environmental Science Services Administration (ESSA) has been checked out by the National Aeronautics and Space Administration (NASA) and turned over for operational duty.

Improved TIROS Operational Satellite-1 (ITOS-1) was launched by NASA on January 23, 1970, and given an exhaustive five month engineering check out.

Operational coverage from weather satellites will be more than doubled with the use of ITOS-1 due to its ability to take day and night cloud cover pictures. The spacecraft is in a near polar orbit ranging between 890 and 918 miles altitude and is inclined 78 degrees (retrograde) to the equator. It orbits the earth every 115 minutes.

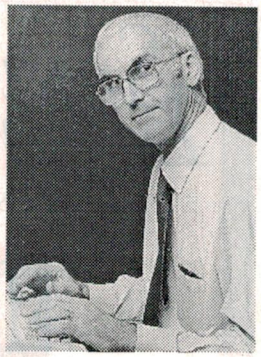
TV traffic surveillance: Television cameras will be used to supervise Melbourne's Westgate Bridge when it is opened to traffic.

A closed circuit surveillance system that will provide high quality pictures at night will be installed by Philips Electrical Pty Ltd, who won the contract to provide all the communications facilities for the bridge.

The bridge, to be longer than Sydney's Harbour Bridge, will require extensive communications, costing about $250,000 and including two way radio connections with patrol cars. ❖

FORUM

Conducted by Jim Rowe



Should Morse still be mandatory for a full amateur radio licence?

Some areas of electronics and communications seem to demand our attention more often than you'd think, from a simple consideration of the number of people involved in them. Amateur radio seems to be one of those areas, and this month we're drawn to it again. I've received a number of responses to those 'hate mail' letters I published in the June column, and there's also a letter which re-opens the question of whether Morse code should still be a mandatory requirement for a radio amateur 'full call'.

You may recall that in the June column, I published quite a few of the 'hate mail' letters which arrived in response to my editorial in the March issue, regarding the SMA's proposal to increase amateur radio licence fees. I'm happy to say that most of the people who have been motivated to write in response to these letters have been quite supportive, as you'll see shortly.

However one reader was was decidedly *not* supportive; quite the opposite, in fact. The reader concerned is Mr Lindsay Tower, VK4AAZ, of Innisfail in Queensland, and he was so upset that he sent in the following message by fax, addressed to 'The owners of ETI/ General Newspaper Pty Ltd':

I have just read some of the June 1995 issue, in particular Forum. I am offended by Jim Rowe's remarks on amateurs generally, and will not be buying any more of your publications.

He should be SACKED IMMEDIATELY, no matter what the effect. Bloody outrage!

Well, there you are; short, and to the point. There's no doubt Mr Tower was quite upset — but what was it, exactly, that made him so upset that he wanted my immediate dismissal? That's where I'm really puzzled...

In the header section of the fax, he refers to the 'last four lines, page 43'. This was where I was commenting on the letter from Mr Tower's fellow Queenslander Mr Robinson-Pedder, who had described the 28-29.7MHz amateur band as being 'unwanted'. Here's what I had to say, in those lines and the couple before them:

I wonder if all amateurs would take that view, and would be happy for hams to lose that band? I would have though that this spectrum segment would have significant value for anyone involved in serious investigations into propagation, but perhaps I'm wrong here too.

That's it, then; not one of the more inflammatory passages of that column, I would have thought — but perhaps Mr Tower is reading more into my comments than I intended. I can only guess that the 28-29.7MHz band has some special significance for Queenslanders, and even talking about it is enough to have them demanding one's blood.

By the way, did you note that Mr Tower addressed his charming little fax to the owners of 'ETI'? Presumably he hasn't noticed that that magazine has been part of *EA* for quite a while now — since June 1990, in fact.

More favourable

Now let's look at some of the other responses to the June column, which have been rather more favourable. The first comes from Mr Angus Witherby, of Invergowrie in NSW, who has contributed to Forum in the past. Here's what Mr Witherby has to say:

I am writing to express my support for you and the magazine. I suppose everyone who works in a public area experiences at some time or other the 'hate' that has been recently directcd your way — not that that makes it any less distressing and hurtful. I admire your courage in publishing those comments in this month's Forum, particularly those that were (to my mind) way over the top. I feel that you have done all — indeed more than was necessary to make amends for what was, after all, a quite minor slip.

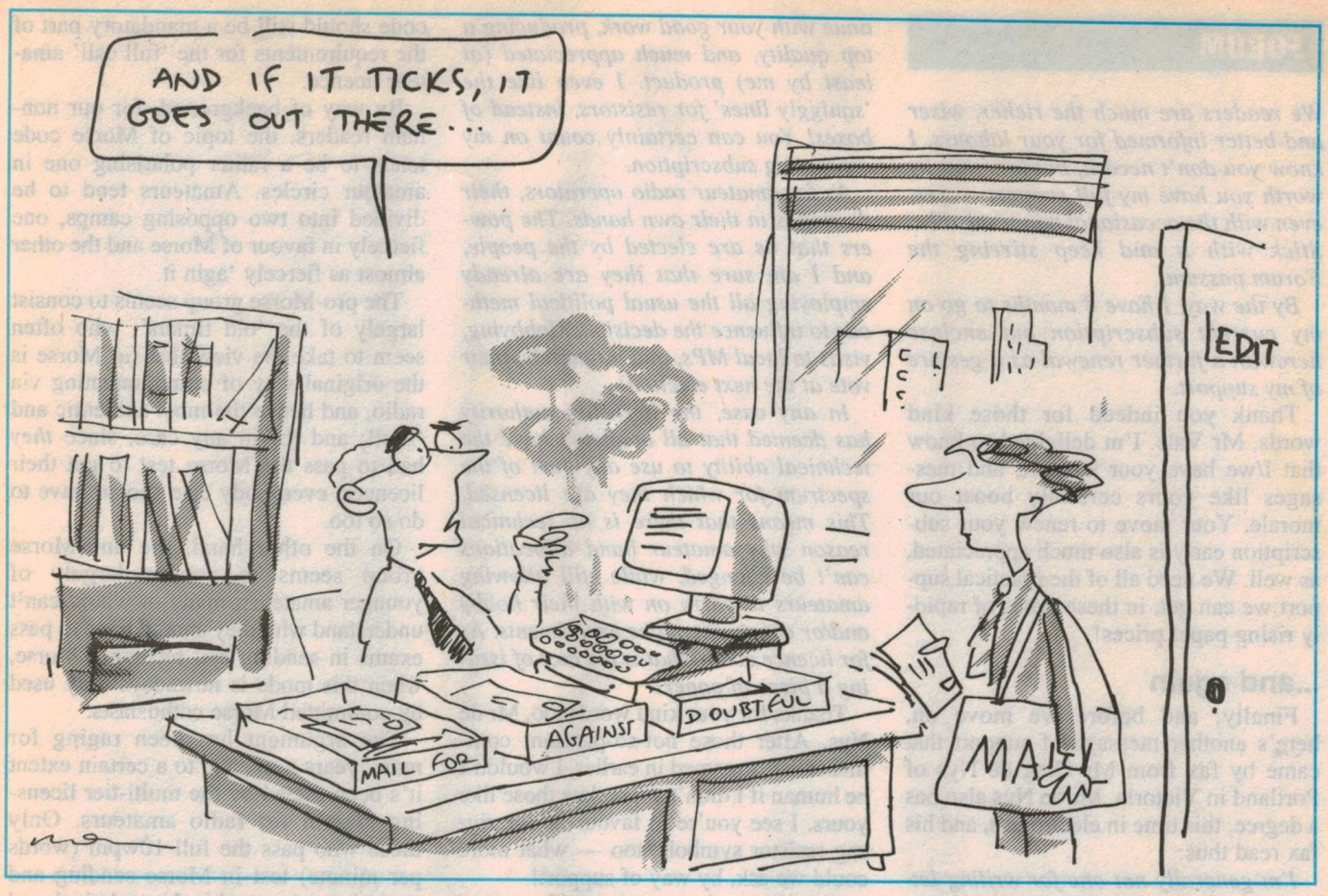
I would be very disappointed if the comments from (I hope!) a small percentage of the amateur fraternity, were to divert discussion from some very real issues associated with the federal government's policies for spectrum management being currently carried out (generally quite reasonably, in my view) by the SMA.

I have recently reviewed both the discussion paper relating to apparatus licensing and the more recent discussion paper on spectrum licensing. Whilst there is much to commend in the intent of the government and the SMA, to simplify and clarify the system and to remove some clear inequities, I have major concerns over some of the philosophies underlying the system.

In particular, there seems to be a strong focus on the use of purchasing power (read dollars) as the allocator of scarce spectrum, with only lip service given to social and community needs. As I outlined in a recent submission to the SMA on behalf of a major public service provider, the 'dollars buys access' method is simple, and it works; but it is not likely to produce the best value for the community at large.

Of even more concern is the apparent attitude that scarcity of spectrum, combined with the SMA's position as a 'monopoly provider', entitles the government to charge monopoly rentals for spectrum access so that 'the community' can recover the 'value' of this scarce resource.

It is my clear view that the federal government is not entitled to any profit on the use of spectrum. Their target should be cost recovery only, and that they need to deal seriously, systemati-



cally and fairly with non-price issues in allocation.

I have only touched here on a few of the issues raised in what is a very complex area of policy. I would therefore be most interested in your views on the discussion papers outlined (If you can bear further thought on the topic!) particularly given some of the 'national park' proposals through class licensing (OK for CB, why not some amateur bands as well?) and the 'private park' proposals for spectrum licensing (could the amateurs lobby for some bands to be licenced to a representative association?)

Thank you for your support, Mr Witherby, which is much appreciated. I tend to agree with you that although the 'dollars buys access' or spectrum rental/auctioning system undoubtedly works, it isn't necessarily going to produce the best value for the community at large.

I guess it's another aspect of the way 'solutions' to short-term needs can often turn out to generate more problems in the long run, don't you think? No doubt the idea of taxing spectrum usage is an attractive one for Governments, because it provides another source of revenue. But as many of the uses to which the spectrum is put are essentially 'in the community's interest', this can easily result in unforeseen problems.

Certainly I'd agree that you can develop a strong case for arguing that the Government's spectrum management should be on a 'cost recovery' basis only, as you say. Of course if they don't raise the revenue they need from us via the SMA, they'll probably have to peel it from us all some other way. But that's the point at issue, I guess — taxes will always be with us; the challenge is to find the most equitable ways of extracting them!

More support...

Moving on again, another vote of support came as a fax from Mr Mike Vale VK1VW, in Canberra. Mr Vale, who also has a degree in electrical engineering, had this to say:

I have just read your June 1995 Forum column, and feel quite saddened and sickened by the vitriolic outpourings of some of your featured correspondents. The more extreme manifestations of human nature continue to amaze me, but it is a long time since I have seen anyone fly into such a towering and incoherent rage over such an issue.

Was there something I missed, or is life as we know it really about to come to an end because you made a small mistake and we are to pay a few dollars more for our licences — this appears to be the thrust of the comments by Mr Millar in particular. Argue against the rise as hard as you can by all means, but keep a grip while you are doing so.

I have been an avid reader of Electronics Australia since the 1970s, particularly the Forum column under Neville Williams' stewardship and then your own. I value the way that you explore contentious issues without demeaning, patronising or alienating the supporters of either side of the argument, and your measured replies in the face of sometimes grossly ignorant and vehement provocation are lessons in objectivity, temperance and good journalism.

I have edited several magazines in my time and know how much effort is involved in the process, and how hollow the feeling is when one's efforts go unrecognised, or worse, are rejected. Especially when the rejection is peppered with such extravagant personal abuse.

Electronics Australia is a great magazine and you are a damn fine editor.

We readers are much the richer, wiser and better informed for your labours. I know you don't need it, but for what its worth you have my full support — yes, even with the occasional minor mistake. Stick with it and keep stirring the Forum possum.

By the way, I have 8 months to go on my current subscription but enclose herewith a further renewal as a gesture of my support.

Thank you indeed for those kind words, Mr Vale. I'm delighted to know that I/we have your support, and messages like yours certainly boost our morale. Your move to renew your subscription early is also much appreciated, as well. We need all of the practical support we can get, in these times of rapidly rising paper prices!

...and again

Finally, and before we move on, here's another message of support that came by fax from Mr Greg de Nys of Portland in Victoria. Mr de Nys also has a degree, this time in electronics, and his fax read thus:

I'm generally not one for writing letters, so the fact that I am writing you one now, is a reflection of the level of my concern. The number of negative, and even abusive letters that you received and published in your Forum column in the June edition, were completely unwarranted.

I don't really care how big a mistake you may or may not have made. You seem to me to be the sort of person who would want to do their best to make good any mistake you may have made. In any case, no one deserves the degree of personal abuse that you were forced to endure in some of those letters.

Just let me say, Jim, that I have been an EA subscriber for quite a number of years and, in my opinion, the magazine has an enviable position in the marketplace ("Australia's largest selling electronics magazine"), mostly due to the level of journalistic quality, integrity, and professionalism attained by you and your staff, under your leadership. The magazine is a credit to you and your publisher.

I particularly like the technical articles and projects, many of which have been authored by you. Even my wife enjoys reading the articles on space exploration.

I would like to encourage you to continue with your good work, producing a top quality, and much appreciated (at least by me) product. I even like the 'squiggly lines' for resistors, instead of boxes! You can certainly count on my continuing subscription.

As for amateur radio operators, their destiny is in their own hands. The powers that be are elected by the people, and I am sure that they are already employing all the usual political methods to influence the decisions (lobbying, visits to local MPs, and ultimately, their vote at the next election).

In any case, the licensing authority has deemed that all amateurs have the technical ability to use any part of the spectrum for which they are licensed. This means that there is no technical reason why amateur band allocations can't be changed, while still allowing amateurs to carry on with their hobby and/or communications experiments. As for licence cost: What is the cost of issuing a piece of paper?

Thanks for your kind words too, Mr de Nys. After those not-so-pleasant comments that streamed in earlier, I wouldn't be human if I didn't appreciate those like yours. I see you're in favour of our zig-zag resistor symbols, too — what more could we ask, by way of support!

About the only part of your fax where you lost me was that final question. Did you mean that since radio amateurs are restricted to fixed bands, issuing licences should really only involve typing a few details on a form, and mailing it out?

I agree that on the surface it may *seem* like that, Greg, but we shouldn't forget that the SMA is also expected to keep an eye out for anti-social behaviour, out-of-band operation and so on. They're also involved in investigating complaints regarding alleged interference by amateur equipment with TV reception, hifi system operation and so on. So in reality the overall cost of managing even the amateur bands is rather more than simply that of 'issuing a piece of paper'.

I don't think many amateurs would want to disown their responsibilities in paying for their fair share of the SMA's costs in performing these functions. It's the additional 'spectrum usage tax' component that causes all the arguments...

Mandatory Morse

But let's move on now, to a topic that's still in the realm of amateur radio, but in another area — and one that if anything, has the potential to be even more controversial than licence fees. It's the hoary question of whether Morse code should still be a mandatory part of the requirements for the 'full call' amateur licence.

By way of background, for our non-ham readers, the topic of Morse code tends to be a rather polarising one in amateur circles. Amateurs tend to be divided into two opposing camps, one fiercely in favour of Morse and the other almost as fiercely 'agin it.

The pro-Morse group seems to consist largely of the 'old timers', who often seem to take the view that (a) Morse is the original way of communicating via radio, and hence the most authentic and 'best'; and (b) in any case, since *they* had to pass the Morse test to get their licences, everybody else should have to do so too.

On the other hand, the anti-Morse group seems to consist largely of younger amateurs, many of whom can't understand why they should have to pass exams in sending and receiving Morse, when this mode is nowadays only used by committed Morse enthusiasts.

The argument has been raging for many years now, and to a certain extent it's been fueled by the multi-tier licensing system for radio amateurs. Only those who pass the full 10wpm (words per minute) test in Morse sending and reception, along with the technical and regulations knowledge requirements, can qualify for the 'full' or 'unrestricted' licence, to operate on all amateur bands with full power.

Those who pass a less rigorous 5wpm Morse test can qualify for the Novice licence, entitling them to restricted operation on certain bands only (mainly HF), while those who either don't sit for or don't pass the Morse tests — meeting only the technical and regulations knowledge requirements — can get the 'Limited' licence, and can operate only on the VHF and higher bands. (I'm one of these, I admit.)

There's also a 'Combined' licence, for people who pass the technical and regulations exams but only meet the 5wpm Morse requirement.

This 'segregation' is largely due to international agreements, by the way, and is based on the fact that the traditional bands used for international communications are in the HF part of the spectrum. But the nett result is that the HF bands tend to be populated mainly by pro-Morse people, while those who are anti-Morse tend to be found mainly on the VHF and higher bands...

By the way, the argument tends to be not about whether Morse is an effective

communications mode, nor whether amateurs should be able to use it if they wish. It's more over the question of whether an exam in Morse should be a mandatory part of the requirements for a 'full' amateur licence.

Right — with that preamble over, I can introduce our next letter. It comes from Mr Bob Harper VK4KNH, of Kingaroy in Queensland, who is a TAFE teacher, and who would like us to open the topic again for discussion. I gather he was prompted to write by a pro-Morse article that appeared in the February issue of *Amateur Radio Action*, written by Neil Duncan.

Anyway, here's what Mr Harper has to say (with a small amount of 'pruning', due to lack of space). He gave it the title 'CW — The King is Dead, Long Live the King':

As an amateur for nearly 20 years, I am well aware of the continuing controversy over the use of CW as a measure for licensing Amateur Radio Operators. I began like so many as a CB operator, who stepped up to Novice and then to the Limited licence. The two were later combined into what is now known as the Combined Licence.

I consider myself as an AOCP operator, having passed all of the necessary theory to operate, and especially to experiment on the air waves. In no way do I feel 'Limited' in comparison to the 'Full Call' operators, who have only 5wpm more CW to brag about.

Indeed I teach amateur radio and am an accredited amateur radio examiner, who has tested several people who are now full calls. I have given quite a bit of my time to not only enjoying amateur radio, but to assisting others into the hobby.

So why am I still not a full call? I guess that I simply don't accept that telegraphy is essential to every licenced amateur. I have even passed 10wpm sending, and had a couple of attempts at the receiving without success. I simply wasn't committed enough, and don't complain that I can't do it; more that I haven't found it necessary. Maybe one day I will pass the test, even if CW is no longer required.

Now you have some idea of who the writer is, perhaps I can put my case for removing CW from the testing for licences. Like Mr Duncan, whose article I enjoyed reading in February ARA, I have looked at the topic from both sides — for and against. I would even like to speak to some of Neil Duncan's points. I am however definitely convinced that the removal of CW testing is in the best interests of amateur radio, and make no excuses for being so inclined.

There's no argument that a digitally generated signal is far more likely to get through and be receivable than a complex form of modulation such as voice — providing of course the recipient has suitable receiving equipment and or expertise. CW can quite easily fit the bill and can be generated by hand or by circuitry. In fact machine generated CW will be more likely to get through if both the transmitting and receiving equipment make use of the technology available today — ala Paket or other RTTY forms. I.e., telegraphy is only one form of CW (or is it ICW?)

A CW signal does indeed require minimal equipment, not usually available today as more 'Black Box' operators come along. It does however rely upon an operator proficient in CW, not only when tested but for the rest of their licensed life. Not all full call operators are apparently prepared to keep up their proficiency, and indeed I would love to be a fly on the wall if ever they are required to prove such proficiency in order to keep their licence.

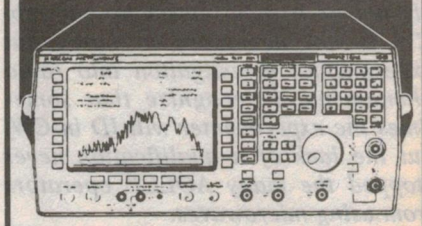
Certainly 'You can cram more CW QSO's into a given spectrum...' and pass less information in a greater time as well. But fair enough, more people can access the same commodity, and we must be seen to use (i.e., occupy) and share the resources we have been allowed to use.

International conventions aside, many operators learn a second language through voice operations with overseas contacts; I can even talk American now! As well as some German, Japanese, even a little Spanish, Russian and Italian. The accent is simply not the same on CW and in reality, Japanese, Russian and Arab CW is not receivable by someone who knows standard CW (International Code).

But all these statements do is discuss the use of CW on air. It does not address the issue of whether CW should be a requirement for licensing.

Most operators, full call or novice, would agree that CW operation on air is a damn sight easier than that required to pass the test. QSO's rarely have a 96% pass mark and when conditions are poor, operators compensate by 'sending every letter twice'. It is such a pity that the exam tapes don't have such good manners. Good communication requires feedback and the exams simply fail on that point. You see I am a TAFE Teacher

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and I simply could not accept the exam conditions as being valid for the skills supposedly being assessed.

In industry terms, the CW would simply not be a requirement for the job. CW is not necessary to carry out experimental investigation into radio phenomena. I recognise that sometimes the experimenter will ID in CW, but the lack of a qualification never stopped the many AOLCP operators from using microwaves.

Neil Duncan's argument for CW fails in my opinion to give any credence to the basic belief that CW is a licensing necessity. CW being essential in time of emergency is not valid as many more efficient means of communications are available, able to carry greater traffic at a lower error rate. This fact is recognised by all emergency services organisations.

That CW 'keeps up the standard and brings in a better class of operator' is blatantly discriminatory against ordinary persons — but especially handicapped people, many of whom are already using amateur radio after gaining exemption from CW. Thanks to some sensible consideration of the SMA, who seem generally more supportive than some amateurs.

Counting the number of CW QSO's on the HF band should have attracted some kind of Listeners Award, but I cannot see any point to this argument either as those people using the other modes were not required to prove competence at their chosen mode before operating. None were required to send a SSTV picture, RTTY message or even a voice message before operating on HF, so why do we assume that the only people capable of operating on HF are those who have passed a CW test?

Why do we assume that in order to enjoy CW we have to first pass CW? Do older CW operators really mean to say that the only reason that a person has to pass CW is because they did? The final comment is far more likely to come up whenever you ask a full call why CW must be a condition of licensing.

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The ITU argument shoots itself in the foot. CB operators, Flying Doctor operators and many others use the HF spectrum without CW. Why not? If others, with a much lower standard of training than amateurs, are permitted to use the HF spectrum without CW then how can this rule be valid. It is in the least antiquated. Again it is unnecessarily discriminatory against us.

The ITU should be brought up to date, and some sensible purging of antiquated rules would be appropriate. Australia should not only agree to this position but should lead the way. If other services have had this requirement waived then amateur radio could, and should, have the same courtesy given to us.

In Neil's arguments against CW some commonly made points have been aired. The 'I am never going to use it anyway' argument is very common, but in itself does not help my cause or that of any operator who objects to the test. I will use CW, and have used CW. Unfortunately the first time I used it was on 144MHz, having two licences at that time — a Novice Licence and a Limited Licence. I was challenged, in FM, by a full call trying very politely to inform me that although I passed a 5wpm test for NAOCP, I could not use CW at any speed as a Limited Operator.

What rot. How can that type of attitude help the cause of amateur radio? I am not against CW, never have been and never will be. I simply object to and reject the idea that CW is essential to being a good amateur operator. It is simply not true.

As amateurs we should always respond to the call for assistance in emergencies, and as such should practice the setting up of emergency stations and traffic handling procedures. Indeed the John Moyle Field Day is a classic exercise in emergency preparedness.

We should be prepared to use whatever mode is necessary for communications to be made. But do we need to be tested on just one aspect of that preparedness. With the proliferation of Paket equipment today, perhaps we should concentrate on a co-ordinated approach using Paket.

I hope Mr Duncan accepts my argument in the same sense of good debate as I have his, and hope that all amateurs can carry on this debate with an objective mind and not allow personal interests to generate personal attacks. We are expected by the community to be above that, and I hope that we are.

Finally, I would encourage all amateurs to rethink the situation, whatever your long held beliefs might be and consider the future of amateur radio. Consider the current numbers of licences, the next generation of Australians and indeed the youth of this world. They are growing up surrounded by a different technology to that experienced by our generation.

We need to encourage our youth to be more technologically aware than we were, and to be able to compete in the world market we need the next generation to accept technology now. We need, as amateurs, to help our country's growth by taking the young people into our fold. We do not need to bar them by imposing unjustified testing procedures on their entry into our most enjoyable hobby.

Give the kids a go. Don't lose amateur radio simply because you are too conservative. Please avoid giving the world the impression that amateur radio is the pastime of 'Grumpy Old Men' who don't want to share it with anybody — or it may die with you!

CW is history. The kind of history worth keeping alive, but not by imposing it on those who object to it. It will live on as long as people enjoy the freedom of using it when they wish to.

Well, there you are. Food for thought, isn't it? My thanks to Bob Harper for an interesting contribution, clearly written by someone with a deep committment to the long-term viability of amateur radio.

If you'd like to send us your own comments on this topic, or others, please feel free.

Contribute via the BBS

By the way, if you have a PC and modem it's now possible to send in your contributions to Forum, Letters to the Editor or Information Centre electronically, via our computer BBS. This may be easier for you, and also for us (we won't have to scan in your letter or fax).

You'll find a new option on the main menu leading to the 'postbox' areas for these columns, and you can either type in your messages 'live' or prepare them first and simply upload them using say ZModem (which will be cheaper, of course). If you do upload them, though, *please* ensure that they're in plain-text ASCII file format so we don't need to do a lot of messy file conversion.

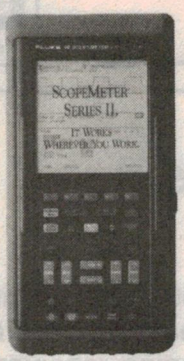
The number for the BBS is (02) 353 0627, and you can set your modem for any speed up to 28.8kb/s (full duplex, 8N1 format).

I hope you'll join me here in Forum again next month. ❖

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FEATURES	91	92	96	99
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Continuous Autoset	•	•	•	•
Automatic Setups	•	•	•	•
Long Term Recording	•	•	•	•
DMM + Waveform	•	•	•	•
True RMS Volts	•	•	•	•
Continuous Beeper	•	•	•	•
10 ns/div to 60 s/div)	•	•	•	•
1 mV/div to 100V/div)	•	•	•	•
Digital Trigger Delay	•	•	•	•
RPM, Temp functions	•	•	•	•
Current Clamp Scaling	•	•	•	•
Scope Cursor Readings	-	-	•	•
Glitch Capture - 40 ns	•	•	•	•
Screen Memory	-	-	5	10
Waveform Memory	-	-	10	20
Set-up Memory	-	-	20	40
Waveform Math & Filter	-	-	-	•
Signal Generator	-	-	-	•
Component Tester Output	-	Volts & Current		•
RS-232-C Interface	•	•	•	•
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Backlit Display	•	•	•	•
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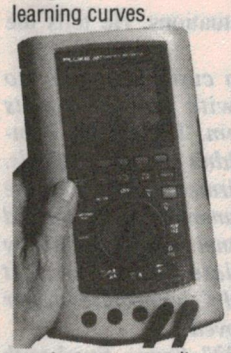
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FEATURES	863	865	867
Basic dc accuracy	.04%	.04%	0.025%
30 mA dc accuracy	0.1%	0.05%	.05%
Current ranges	4	6	6
Frequency counter	2MHz	>10 MHz	>10 MHz
AC bandwidth (-1 dB)	300 kHz	300 kHz	300 kHz
Display bandwidth (typ)	1 MHz	1 MHz	1 MHz
Logic activity	-	•	•
Component test	-	•	•
LCD backlight	-	•	•
Internal battery charging	-	•	•
Waveform memory	-	•	•
Alkaline batteries	•	•	-
Battery eliminator	-	•	•
NiCad batteries	-	-	•
Optically Isolated RS-232 cable & adaptors			•
FlukeView 860 software	-	-	•

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FEATURES	83	85	87
Digital Display	4000	4000	4000 19,999 in high res. mode
Analog Readout	43-segment	Analog	
Bargraph		Pointer	
AC/DC Voltage (400 mV to 1000V)	•	•	•
AC/DC Current (400 uA to 10A*, All Fused)	•	•	•
Resistance	•	•	•
Freq. & Duty Cycle	•	•	•
Capacitance	•	•	•
True-RMS Vac, Aac	-	-	•
1 ms Peak Hold	-	-	•
1000Vrms Input with Input Alert™	•	•	•
MIN/MAX Av. Recording Mode with MIN/MAX Alert™	•	•	•
TouchHold & Rel.	•	•	•
Splash & Dust Proof Holster w/Flex-Stand™	•	•	•
EMI Shielded	•	•	•
Backlit Display	-	-	•
UL 1244 Listed	•	•	•

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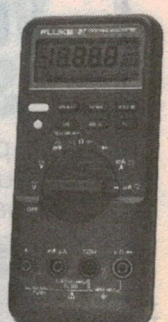
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Model 87: A true-rms ac meter with a 4 1/2-digit high resolution mode (19,999 counts), the 87 offers 1 ms Peak Min/Max Hold and a high resolution analog pointer. The 87 has a backlit display, enabling clear readings in poorly lit locations.



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THE SERVICEMAN

The Sanyo that wouldn't change channels, after it upset the family cat!

I have three interesting stories for you this month. One is about a touch-tuning circuit which had an unusual and rather embarrassing reason for being locked to one channel, while another deals with a very hard to find intermittent fault in the muting circuit of a scanning receiver. Finally, I have a story about a customer who wanted to reclaim a dud set long after I'd been told to junk it — and had done so!

As I move into semi-retirement, there will be more room for contributors' items each month. I don't know if that pleases you, but it certainly pleases me. It means I don't have to take on the hard jobs any more, just to provide material for these pages!

By the same token, it gives me more time to enjoy the pleasure of reading your contributions, and editing them ready for publication. So keep up the good work! There's fame and fortune (well, a modest fee, at least) to be had by the authors of good servicing stories...

Now to business. First contribution this month comes from Tom Buckland, of Howrah in Tasmania. We've heard from Tom once before, and this time his story is about one of the more repulsive aspects of TV service. See what you think.

Tom is a serviceman with a great deal of quite serious experience behind him, but he can still see a funny side to the most bizarre situations. He tells the story thus...

I was called to a customer's home to look at a TV set with problems in its touch tuning system. The owner complained that he couldn't change channels. This I quickly confirmed, noting that the set locked onto channel 4, and changed to the desired channel only momentarily when the touch plate was touched. It reverted to channel 4 immediately after the finger was removed.

The set was a 22" Sanyo fitted with an 80P chassis. I knew that the touch tuning circuit for this model contained two ICs, each of which selected one of four channels. I suspected that the latch in one of these chips had failed, and replacing the IC was really a workshop job. So back it went.

On the bench the fault persisted, so I removed the tuning panel, preparatory to locating and replacing the faulty chip. But once out of its cabinet, the panel performed perfectly. It would select up or down and latched onto the selected channel every time. This led me to reject the bad chip scenario and to change my ideas to a dry joint or cracked board. These sort of faults not uncommonly play up only in the cabinet, under the twisting effect of overtight mounting screws.

I put on my headband magnifier, without which my ageing eyes are nearly useless, and went over the board in minute detail. I bent and tapped, heated and cooled both the board and its components; but all to no avail. I drew a complete blank, which just about described my mind at that time.

The only thing which could explain the absence of trouble was that — perhaps — I had disturbed something during the removal from the cabinet. So in the hope of seeing what I might have done, I replaced the panel and would you believe, the trouble was back again, exactly as before! I repeated the exercise several times but there was no mistake. Out of the cabinet, the panel was faultless; in the cabinet it played up.

The channel selection system in this set is a fairly common one. It uses the touching finger to complete a high impedance circuit between an AC supply and the input to the appropriate latch circuit in the ICs. The actual contacts comprise a small metal plate on the IC side, surrounded by an oval metal ring connected to the AC supply. These were normally separated by the insulating plastic of the cabinet but were bridged by the finger when a channel was selected.

Just as I was turning over the possibilities in my mind, the owner rang to ask about my progress. I have known him for many years so I had no hesitation in telling him that his set was OK but that his cabinet was faulty! I don't know if he realised how incongruous that statement was, but it didn't seem to faze him at all.

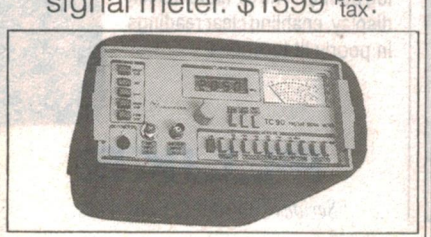
After a pause of a few seconds, he asked "Do you think it might be due to the cat urinating on the set?" It seems that his old female cat has taken a dislike to the TV for some reason, and frequently points her tail at the set and thoroughly douses it.

I suggested that the uric acid crystals might have formed a conducting path between the two plates, or may even have changed the nature of the plastic itself. I used water and a variety of other solvents to clean the area surrounding the touch plates, but nothing worked. I even asked an industrial chemist friend to explain the chemical reaction between cat urine and a plastic TV cabinet, but this produced only disbelief...

So with nothing to lose, I took out my

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trusty needle file and cut away the suspect plastic completely, leaving an air gap between the two contact plates. This provided a total cure and with the set back in its cabinet, the absent plastic was barely noticeable.

I rang the customer to let him know that he wouldn't have to pay for a new cabinet after all, but suggested that he change his feline companions. The changeover might even provide him with a catskin rug! He didn't think much of that suggestion and eventually paid my bill without hesitation.

But I know what I would have done!

Yes, Tom, I'd have done the same thing. It reminds me that I once planned to rig the EHT from an old portable B&W TV to a metal plate around the stem of one of my wife's rose bushes. We were troubled by a local dog who insisted on cocking his leg on every bush in the garden. Unfortunately, another aggrieved neighbour fixed the dog first, with a 'point two two' between the eyes. But that was all out-of-doors. It does makes you wonder about people who could tolerate that sort of behaviour indoors...

Thanks for that tale (or should it be TAIL?), Tom. As mentioned above, there will be room for plenty more.

Muting problems

Now we come to a rather involved story from Peter Laughton, of Albion Park in NSW. Peter has appeared in these pages before, usually with stories about remote area power supplies. This time he is on ground that is more familiar to readers, even if the subject of his investigation is rather less common.

He calls his story 'Round and Round the Phase-Locked Loop'. Read on to see why:

Since we live and work on a farm, and since the recent hot, dry weather presents a serious bushfire hazard, I have a distinct need to monitor the local Bushfire Brigade network. So I dug out my scanning receiver and set it up to scan the appropriate frequencies.

At this point all was well, but a check about 30 mins later showed that the radio wasn't unmuting, and audio output was very low as well. Operating the squelch control unmuted the rig, but the audio output was barely enough to be heard across the room.

Due to the exceptionally hot weather at the time I elected to leave the volume on full and use it as it was. But the fault gradually got worse and finally there was almost no audio output at all. Something had to be done.

The one interesting and potentially useful thing about the fault was that it seemed to be temperature sensitive. It seemed to appear and disappear roughly in time with the daily temperature changes. So, I armed myself with a new can of freezer spray, removed the covers and turned the rig on. It operated perfectly for the next week and no amount of heating or cooling any component anywhere around the muting, audio or even the IF stages made any difference.

Then it did start to play up in an ineffectual sort of way. The mute seemed to drift from 'sort of on' to 'almost off'. Moving the squelch pot restored it to off or on, but the 'sort of' condition remained.

At this point I suspected a fault around the muting or low powered audio stages, and seeing as I had the necessary information about the IC's (though not a full manual), and as there were only a few discrete parts in the area, I expected it would be easy to find.

Measuring some voltages around the area showed that when the fault appeared, voltages rose. About this time I tried to trace out the circuit, but gave up as the circuit board is extremely tightly packed and also seemed to be rather complicated for a simple muting circuit.

I now got onto the local two-metre repeater and put out a call for anyone with a circuit diagram for a JIL SX200 scanner. Finally a local ham who repairs two way radios remembered he had seen the circuit in an old Amateur Radio magazine. He found it in his files but unfortunately, it only covered the receiver, not the PLL or display circuits. Still, it was a start.

Now armed with the circuit, I checked the output of the MC3357 IC and it seemed to be OK, both muted and unmuted and with or without the fault. (I wonder why they didn't use the internal muting pin 14 of the IC. It would have saved a lot of work!)

With the fault present about 8V was appearing at the base of Q7, which shorts out the audio line to the volume pot when it conducts. R145 (22k) measured 26k so it was changed, but all to no avail. Diode D215 was checked for leakage and replaced, even though it was OK.

Then I wondered if Q7 had some strange internal fault that caused lots of leakage under load. So I replaced it with a BC109 but still the fault persisted. I lifted the wires labelled R16 and R19 going to the PLL — and the voltage disappeared. I hoped that this was not going to be a problem with the PLL!

I removed the covers from the PLL board and traced the voltage to pin 15 of the D553C IC. I don't know what it is or does, but it has 40-odd pins and the voltage was definitely there. I also found several potential dry joints on the PLL board, so the exercise was not a total waste of time.

I had no info on the IC and I didn't have a spare. Nor could one be found, at 9:00pm on a Saturday evening. I tried the freezer spray and soldering iron, but the voltage was quite permanent.

On spec, I decided to see if any pins on the IC were influenced by the mute circuit. I found that pin 11 had a voltage the opposite to pin 15. In the IC was an inverter amp. Maybe it wasn't faulty after all. Pin 11 goes to a resistor, then back out to the main board to R10, the mute out to PLL. Q5 was then checked and proved OK, as there was a voltage on its base corresponding to the fault. I spied C127, 10uF 10V electro — and since I distrust all low voltage electro's, I changed it. (It would help if the circuit diagram has all of the component values on it!). Still didn't work.

"What gives here?" I thought. Q7 is fed from pin 13 of the MC3357 and all was well there. One end of R127 was lifted and the voltage remained. The only path was via R126 and although it measured close enough at 10.5k, it was changed anyway. (At 10:00 at night I wasn't going to mourn a two cent resistor!)

With the resistor out, everything returned to normal. The squelch worked and although the muted mode wasn't really quiet, it did mute and unmute cleanly.

The collector of Q5 is fed from the output of IC201, a upc324C quad op-amp, via diodes D213 and D214. A quick check with the meter showed a voltage at pin 7 but none at pin 8. As pins 5 and 9 are linked together, the output should have been the same from both pins with no signal.

Pins 9 and 6 had the same voltage on them, so what else is there? Astute readers probably have seen it already. C235, a 10uF 10V electro! This cap was literally buried between two trimpots, so it didn't get the freezer spray treatment earlier on.

Interestingly, has anyone noticed that with the multimeter probe say earthed or negative, the other probe reads a voltage when placed on the can of one of these leaky low voltage caps? Removed from circuit there is still a resistance from each lead to the case. Maybe this is a quick way of finding a leaky cap?

Replacing C235 brought all operations back to normal. It appears that the PLL turns the mute on harder when scanning or running, as the high level of background noise even when muted disappeared after the capacitor was replaced.

The fault had taken several weeks to find, so the old capacitor was placed on the anvil and hit with a 14-pound sledgehammer. Now THAT was very satisfying!

I know just how you feel, Peter, but I doubt if I would have had the patience to work that one out. In the end it was worth struggling to understand your problem, because now I have a better knowledge of muting circuits in general.

Don't know if it will be of value to me, but knowing anything is better than knowing nothing!

Then, it's not explained in your story but as I see things, you would have to wait for a station to come on air to see if the set unmuted (or not). Depends, I suppose, on how busy the band was; but you could have waited ages for someone to oblige. It's a wonder the job didn't take you months, rather than weeks.

Thanks anyway for an interesting and somewhat different yarn.

Lucky/unlucky break

Now, for something quite different from my own workshop. I didn't know whether to call this story 'A Lucky Break' or 'An Unlucky Break'. It's a bit of both, really. See what you think when I've finished.

About a year ago, a chap brought in a TV for repairs. It was a Samsung 20" model, about five or six years old. The complaint was that the 'picture had gone all green' but when I checked it out, there was no sign of picture — just a totally green screen!

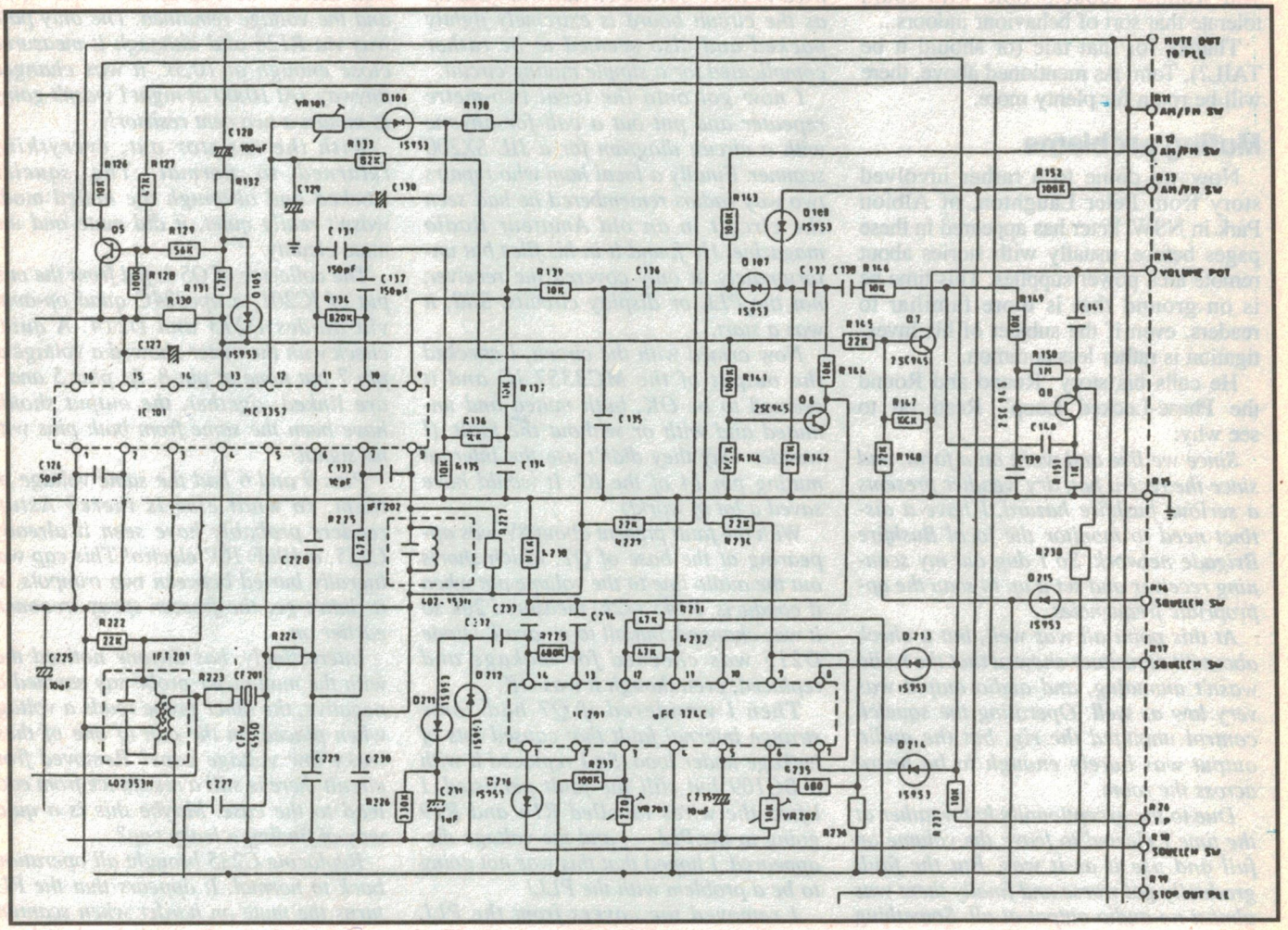
I spent nearly two hours trying everything I could think of to restore a picture, but in the end I had to admit that the tube was faulty. Ultimately, I removed every connection to the green gun and finished up with a magenta coloured picture. Replacing any of the green connections caused the screen to revert to the bright green condition, and at the same time removed any trace of picture.

I don't know what was wrong with the tube, but it would obviously have to be replaced. It looked as though the green gun was totally shorted — grid to cathode to heater and anything else that was associated with green! When I contacted the customer and gave him the bad news, he didn't hesitate. He said he couldn't afford a new tube for the old set and as it was his second set anyway, he would write it off.

When I asked him to collect the wreckage, he said he didn't want it and I could have it for spare parts. This is not at all unusual, so I accepted gratefully, junked the dud tube and the cabinet and put the circuit board away on the 'Useful' shelf.

During the next 12 months, most of the larger parts were salvaged and just recently, during a cleanup splurge, the remains of the board went to the tip. Nothing unusual so far — it's happened to all of us dozens of times. But here comes the gist of the story.

Last month a young lady rang, and asked if I had finished her set yet. It took a lot of discussion before I learned that she was after a 20" Samsung that her



Part of the circuit diagram for the JILSX200 scanning receiver, showing the area in which Mr Laughton finally found the fault. This much copied diagram is not very clear, but it's all that he had to go on. Transistor Q5 is at upper left, while transistor Q7 is near the upper right corner. IC201 and capacitor C235 are at lower centre.

father was supposed to have left with me over a year ago. She had been living interstate for two years and had not seen her father since her return.

When all that had been sorted out, I explained to her that the cost of replacing the dud tube would have been a large percentage of the cost of a new set and that even had she handled the transaction herself, the result would probably have been the same.

Then she hit me with the cruncher. If she had been home at the time, she would have used the dud set as a trade-in on a rental deal. There was at that time a local company who were offering new renters two months free rental on a 12 month contract, with their old set as a trade-in, going or not. It made the old set worth about $55-$60 to her.

The deal is over now, but she still wants a television set for her new flat. She has a five-inch B&W portable that she carried around on her travels, but that is unsatisfactory for general viewing. Then she asked "What was I going to do about it?"

Well, what *could* I do about it? Put yourself in my place!

The original customer (the father) had allowed me to believe that he was the owner of the set. There was no mention that it belonged to his daughter, and when it came to disposing of the carcase, he didn't hesitate to tell me that I could have it. Nothing that happened then, or for the next 12 months gave me any inkling that it hadn't been a perfectly normal transaction between the customer and myself.

Now, we'll leave that story and go back to about the same time as when the Samsung arrived. Another customer brought in an old HMV 18" set and asked if I could get it going for him. He particularly wanted this one fixed, because it had a UHF tuner and his other set didn't. With aggregation now complete in his area, he was missing out on half the available programmes.

As far as I know he is still missing out, because his set also had a dud tube. Not shorted elements (or whatever it had been), but this time emission so low that only the barest trace of image was visible, in a dark room at midnight. I think someone had been trying to boost the tube, and had blown away most of the cathode coating...

Once again I was left with a junk set to dispose of, but this time I didn't dismantle it. Because it was so old (nearly 20 years old) I just stacked it in the carport, ready to go straight to the tip.

Continued on page 47

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AUTOMOTIVE ELECTRONICS



with NICK de VRIES MIAME, AMSAE, FI Diag.E.

Vetronix's new Mastertech analyser

Launched at the recent Automotive Fair was the latest auto diagnostic tool from Vetronix, the handheld Mastertech Multi-Function Tester. Like its predecessors the Tech-1 and Tech-1A, it offers bi-directional communications with a vehicle's electronic control modules. However the Mastertech combines these 'scanner' and 'signal injector' functions with a digital automotive scope and multimeter — producing a very powerful instrument indeed.

It was that time of year again, the annual pilgrimage to the Sydney Showgrounds in May for the Australian Automotive Trade Fair. Every year at about that time manufacturers, resellers and importers converge on the Showground to strut their stuff and vie for customers.

The AATF is without a doubt the biggest array of appetite whetting automotive technology in Australia, where the customers play 'catch me if you can' with sales reps of all persuasions. The attendance was down this year, due I'm sure to the cold and wet conditions that prevailed for almost the duration of the event. Interstate visitors were conspicuously absent, compared to previous years, and fewer locals braved the conditions than was generally hoped for.

On the high-tech front, there was the usual glittering display of diagnostic equipment, guaranteed to keep service garage owners 'poor but happy' in their quest for excellence.

From a technological point of view I felt that this was the most interesting automotive trade show I'd been to in the 10 years. The interaction between manufacturers of PC-based equipment was definitely a 'first', and the name of the game was 'information technology'.



Star of the show

In terms of presentation, the Dyno Dynamics display was unquestionably the stand with the most 'pulling power' (sorry about the pun, Mr Hodges!). It stole the show with PC-based control systems running all manner of chassis dynamometers for go-karts, motor cycles and four-wheel drives, as well as engine dynos for stationary engines and dragster engines of humungus horsepower.

According to managing director Chris Hodges, the technology employed by Dyno Dynamics is at least five to seven years ahead of their nearest rival, and looks set to become an export earner for Australia.

New class of tester

All manner of fault finding diagnostic tools and equipment adorned the stands throughout the buildings, ranging from 'affordable' to 'your house as a deposit, please'. In the affordable group was a very interesting piece of hardware/software technology by Vetronix, who were responsible for introducing the GM Tech 1 scan tool to our Holden dealers back in mid 1988.

The latest Vetronix model, distributed by ATRA (Australian Transmission Rebuilders Association), is badged as the Mastertech and is fully 'backwards compatible' with the software cartridges for the Tech 1 and 1A. But the technology has now taken a quantum leap forward with the addition of an on-board

digital oscilloscope, with digital voltmeter, frequency and duty cycle measurement included and housed in a ruggedised case.

Instead of the usual four-line display screen, the Mastertech sports a large 75mm x 75mm LCD screen that can be configured by the operator to display voltmeter functions, 'scope traces, data scanner readings and fault codes, or combinations of each. The 23-button tactile keypad is laid out in a logical format, complete with HELP key in case the operator gets lost in the program or doesn't know what to do next — which sure beats carrying the manuals around with you from car to car.

Fig.1 indicates the extent of the technology crammed into this compact tester. The high speed bi-directional RS-232 port connects to display terminals, computers, printers or PC-based diagnostic engine analysers (such as the Autodiagnostics ADS9000 I reviewed in last December's edition).

There's an 'Instrumentation Port' that takes in the signals for oscilloscope and multimeter functions, and also provides signal injection capabilities for those who wish to trigger ignition systems and ECU's in order to monitor the results. The port supports a range of measurement devices, from pressure transducers, temperature probes, vibration analysers, and also contains a serial communications link called the 'Instrumentation Bus'. According to the accompanying literature, this bus allows the Mastertech to be connected to microprocessor-based instruments such as a 'smart breakout-box'.

I'm not sure what a smart breakout-box might be, as we have yet to see such a device in this country for the automotive environment; but stay tuned and we'll see what can be unearthed for a future issue.

Scope included

The inclusion of oscilloscope functions make this tester simply outstanding. The standard lead set includes a signal conditioning interface box that limits input signals to +/-20V DC, however an enhanced lead set is on the way to remove that limitation and allow the complete waveforms of fuel injector and ignition coil switching to be viewed.

Signals acquired through the diagnostic lead set can be saved into memory, printed out via the VP-411 Vetronix printer or down-loaded into the *TechView for DOS* or *TechView Plus for Windows* software programs. The *TechView Plus* program on display at the show graphically presented individual readings in Bar Chart, Line Chart or Overlap Line Chart modes. Combinations of digital readings acquired from the vehicle's data stream were presented a page full at a time, with 'Select' buttons alongside each one to choose different parameters for analysis.

Add to this the ability to attach a Five-Gas Analyser to the PC with the *TechView* software, and you have a mini Tunescope for the latest cars, with some really clever use of electronics.

Conforms to OBD2

A new standard for vehicle serial data streams has made the game significantly more streamlined for manufacturers of this kind of test equipment. All current production vehicles to be sold in the USA must be fitted with a diagnostic socket that complies with the OBD2 standard.

This was introduced by the US Government as part of a wide ranging plan to improve repairability and emission systems longevity of motor vehicles. After consultation with the motor industry an agreement was reached to standardise the diagnostic socket shape and pin-outs, and it seems that most of the world's manufacturers are following the US lead.

So what does this mean to the general repair industry, you may well ask? Well for starters, there is the advantage of having to purchase only one tester that covers all makes and models. In addition there's the prospect of (almost) being able to write off all of those infuriating 'vehicle specific' adaptors. Thus the repairer stands to save literally hundreds, if not thousands of dollars, for adaptors that he may seldom if ever use.

Where the 'vehicle specific' adaptors still tend to come in, is that part of the OBD2 socket specification includes pins that are allocated at the discretion of each manufacturer.

A bi-directional interface for controlling the vehicle's ECU base settings and performing interactive tests on transmissions and ABS brake systems can be added to the Mastertech's repertoire as an 'OEM enhanced' OBD2 kit.

So far the Mastertech's software cartridges are for the OBD2 range of vehicles only, however on hand at the show to demonstrate the Mastertech/TechView range was Ron Dyke, US Sales Manager for Vetronix, who has taken a personal interest in the Australian market. The backwards compatibility to the GM Tech 1 data stream scanner is already an asset, and more vehicles will be added to the already impressive list by August this year.

Part of the changes needed for our market will have to include making the metric conversion feature suit imperial gallons rather than US gallons, for those of us who still like to work out fuel consumption figures in the pre-1973 system (yes, it's really been that long). At 3.8 litres to the US gallon the resultant economy figures could work out rather startling to say the least!

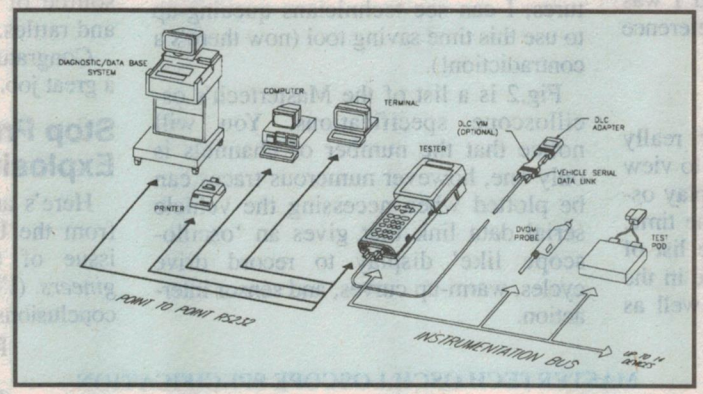


Fig.1: Connectability Plus! System expansion is the key to this heavyweight system analyser.

Trying it out

Having arrived back from the Sydney show, I made contact with ATRA luminary Peter Cardiff and Adelaide's ATRA man-on-the-spot Grant Nache, to secure some 'play time' with the Mastertech.

As usual with this kind of equipment, trying to absorb the operating systems etc., in a short space of time to write a report, tends to leave a residual bead or two of perspiration on one's forehead. So when a piece of equipment operates in an intuitive manner, it does make for a favourable impression at first meeting.

I believe what customers are looking for these days is tools that can be used straight away, with minimal reading and a fair degree of operational simplicity. Most people have enough on their plate without a manual the size of the Sydney phone directory to contend with. Having said that, I spent about 15 minutes reading the manual, familiarising myself with the Mastertech control panel. Then I relied on the screen to help me through the rest.

What impressed me immediately was the quality of the fittings and connections. Vetronix is well aware of the type

of environment their tools have to work in, and the hook-ups bear testimony to a thoughtful design team. The 160 x 160 pixel LCD display does a nice job in most cases, of displaying waveforms accurately.

Once, when connected to the 'Tach' signal on a Delco system, I fancied there was a slight notch in the top of the wave; but amplifying the display to 'zoom-in on the spot' was sufficient to reveal a clean square wave.

Along the bottom edge of the screen in 'oscilloscope' mode are two lines of menu items which bring up choices for things like 'Auto Set', Time and Voltage selections, Trigger Levels, Trigger Source, Rising or Falling edge triggering, and a 'Hold' mode. The top of the screen has the selected settings for Time/Div, Volts/Div, Trigger Level and Edge/Channel. It all works rather well, and I was soon in the swing of it without reference to the 'Help' key.

Multi-function display

Where the diagnostic power really starts to be revealed is the ability to view the vehicle's data stream and display oscilloscope wave-forms at the same time. Technicians can choose from the list of measurement parameters available in the particular vehicle under test, as well as connecting to those same or other signals as required.

This is a great help when trying to diagnose the source of the vehicle's problem. If a fault code appears that doesn't quite make sense, the technician can perform a double-check on the ECU by choosing to read the relevant 'live data' section of the data stream — and with the scope/multimeter inputs, actually monitor the sensor(s) in question.

This is definitely starting to look like the way to successful trouble shooting, don't you think?

Maths functions

One of the features included as standard on the Mastertech is a series of five maths functions. The calculator heads the list, followed by Ohm's Law/ Power Law; a Parallel Resistance calculator; an English/ Metric converter and finally Frequency/Period calculations.

I tried the Parallel Resistance calculator out of interest, but couldn't help wondering who the target audience really is — or what are we in for, as motor mechanics?

To be sure, the modern automotive technician needs to be more than 'the man with the golden spanner' as the Yellow Pages advertisement says, but this is heady stuff.

Most blokes are still struggling with Ohm's Law and voltage drop! But maybe this is the whole point — if it's included as a simple 'put in the values' calculation, maybe mechanics will feel less bamboozled by it all...

Conclusion

I think this offering from Vetronix has all the ingredients for a successful future. Crammed full of powerful features, I can see technicians queuing-up to use this time saving tool (now there's a contradiction!).

Fig.2 is a list of the Mastertech's oscilloscope specifications. You will notice that the number of channels is only one, however numerous traces can be plotted when accessing the vehicle serial data link that gives an 'oscilloscope like' display to record drive cycles, warm-up curves, and sensor interaction.

Combine this with the row of LEDs at the bottom of the screen to indicate an 'on/ off' condition of selected inputs, you've got yourself a serious set of testing capability.

One of the features that must really put the icing on the cake for Lexus dealers is the NVH (noise, vibration, harshness) adaptor available to the Lexus dealership. Toyota advertising claims that the Lexus is the quietest motor car on the road, and in conjunction with Vetronix have produced a specially tuned adaptor that bolts in just behind the driver's seat to pick-up sounds within the car that might be outside the normal parameters.

A future release for the Mastertech is a similar microphone adaptor that will be available for everyone who wants to use the technology to pin-point the source of annoying squeaks, whistles and rattles.

Congratulations Vetronix, you've done a great job.

Stop Press: Explosive air bags

Here's an interesting snippet of news from the UK, care of the March/April issue of the journal *Diagnostic Engineers*. (I'll leave you to draw your own conclusions about the report and the implications for the industry.)

...The extensive use of air bags on automobiles has brought recognition that they are Explosives. They are classified as Class 6 Division 1, Ammunition, UN Classification 1.4S.

Individual local authorities may operate different instructions for dealing with this registration, but you are legally required to register for a Certificate of Registration under the Explosives Act 1875-1976. To register will incur a small charge and you must renew your certificate annually. The cost is usually around 10 Pounds.

When a certificate is issued you must then comply with the storage procedures laid out by that authority, likely to be Mode B storage conditions.

Mode B Explosives need to be kept in a secure steel cabinet with one six-lever lock. It is recommended that the cabinet is fitted to a solid wall.

MASTERTECH OSCILLOSCOPE SPECIFICATION

Parameter	Oscilloscope
Channels	1
Bandwidth	10kHz
Max. sample rate	80,000 samples/sec
Input impedance	1M
Input coupling	DC
Max input voltage	±20V DC (with circuit protection)
DC accuracy	± 3% (500 mS/div) ± 5% (<500 mS/div)
Volt/division	100mV/div → 5V/div
Time/division	0.2mS/div → 20S/div
Time base accuracy	Down to 1µS
Trigger mode	Normal/Automatic/Single Shot/ Hold
Trigger slope	Rising or falling edge
Printer I/F	Yes
Personal Computer I/F	Yes
Cursor/Markers	Yes/Yes
Display Zoom	Yes (2x, 5x)

Fig.2: Bear in mind the automotive application, and the specifications look good...

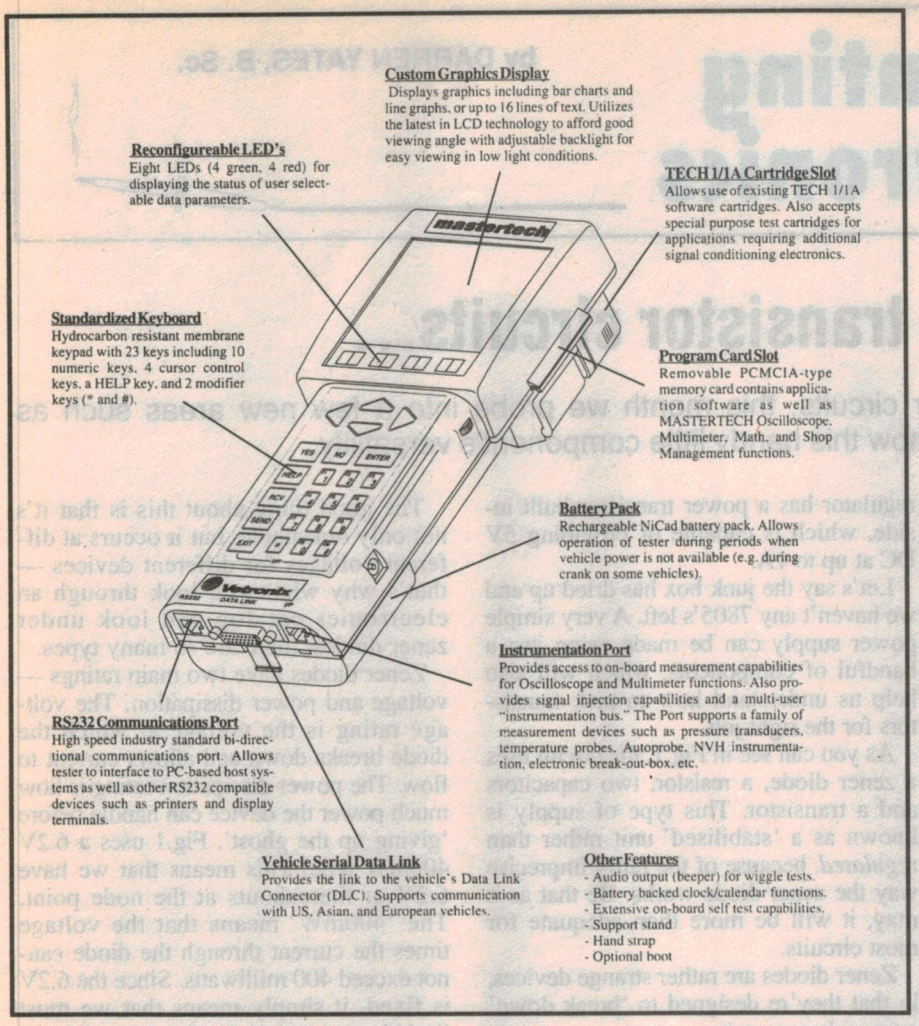


Fig.3: This diagram shows the main features of the Mastertech, made by American manufacturer Vetronix.

The cabinet must have restricted access, any key- holders need to be registered. The cabinet should be clearly labelled for the purpose and away from flammable liquids, excessive heat, or sources of ignition. On no account should anything else be stored in the cabinet with the air bags...

It might be instructive to reflect on the origins of air bags in the USA. The law there requires its citizens to wear seat belts, but few people do as it is considered an infringement of their rights — so the air bag system was developed in an effort to reduce the severity of injuries sustained in accidents.

Now here in Australia, air bags have become a sales tool — promoting the idea that somehow you will be safer in brand 'X' of motor car because they are fitted as standard equipment.

I feel certain that most engineers will agree that if everybody wears their seat belts, air bags do nothing other than inflate the cost of owning, insuring, and repairing a new car. Weren't inertia reel seat belts designed to restrain the occupants and prevent bodies from coming into contact with things like the steering wheel?

Next month

In an attempt at some sort of editorial independence, next month's column will feature a report on the OTC Vision Lab Scope DMM Module, a product that compete's with this month's subject. See you then? ❖

THE SERVICEMAN

Continued from page 43

It's as well that I am not an enthusiastic tip-goer, since a month ago another customer brought in an identical set. This time and for the same reasons, he wanted the UHF tuner reconditioned. Like many of these rotary tuners, it had not been touched for years and had jammed solid.

These tuners can sometimes be freed up, and in this case I offered to try. However, I explained to the customer that if this wasn't possible, I might be able to help him with an exchange tuner from the junked set that was still in my carport. He agreed to this action so I set to work.

When I tried his set on the bench, all I could get was snow on both bands. The UHF tuner was certainly stuck solid so I wasn't surprised to see snow there. But the VHF channels should have been there, yet there was no trace — not even the sound of a VHF channel.

I removed the set back and checked that the antenna lead was properly connected. Then I removed the control panel with the two tuners and looked to see if there was any obvious clues to the trouble. And I'll say there was!

Somebody had tried to remove the shield from the VHF tuner, without releasing the tuner from the panel. There is insufficient room to undo the retaining clips with the tuner in situ, so this someone had forced the clips with a screwdriver. In the process, he had broken the bar that holds the stationary contacts, and had also broken three of the tuner biscuits. He'd fixed that tuner, real good!

So once again I went back to the customer with some bad news. It looked as though I was going to have to replace both tuners, at least.

And I didn't know what other damage had been done to the control panel, by the ham-fisted person who had already been in there. I couldn't predict the ultimate cost of the job, so the customer didn't hesitate. He said "Forget it! Keep the set for junk".

So now I have two identical HMVs, one with a dud tube and one with a dud tuner. I have no idea what will be involved in making one out of two, but with any luck I might have a reasonable set for the young lady who featured in the opening to this story.

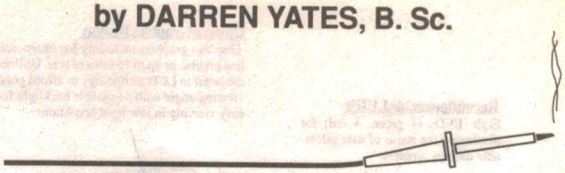
I am satisfied that the two HMVs really did belong to the people who gave them to me. But in most other cases, what is a man to do? Should I demand to see purchase receipts to prove ownership? How can you tell? What would you do?

I know what I'm going to do. I'm going to take a month off to type up a stack of stories from readers. You can make this job a lot easier for me by typing and double spacing your contribution. Then, they only take a week to enter.

I'll be back, RSI permitting, this time next month. See you then? ❖

Experimenting with Electronics

by DARREN YATES, B. Sc.



More interesting transistor circuits...

Continuing our look at transistor circuits, this month we probe into a few new areas such as switchmode power supplies, to show this handy little component's versatility.

So far, we've looked at mainly low power or what is more technically known as 'small signal' circuits but transistors also come in higher power form as well, for higher current tasks.

One of the most common areas where transistors get a guernsey is in your ordinary audio power amplifier. The four-transistor amplifier we presented last month used the medium power BC337 variety, which although being capable of carrying a maximum peak current of one amp, are still pretty small when it comes to carrying a decent load. Now while this isn't really the forum to go into heavy power circuit design, some of the basic ideas of using higher power devices can be seen in even the most simple circuits.

When you move out of the realms of small signal design, there are other factors which you need to consider. Some of these are the maximum power dissipation of the device (Pd), its maximum collector current (Ic) and, in some cases, its maximum collector-emitter voltage (Vce) rating.

If a circuit causes the transistor to exceed any of these ratings, then the odds are that it won't be too long before it needs replacing. On the whole though, most medium power circuits (particularly the ones we'll present here) can use the standard types you'll find in your favourite electronics store. Examples of these are the BD679 series and the TIP31C series, but more on these shortly.

As you would expect, and as an old teacher of mine used to say, "the best way to learn about this stuff is to get in there and do it" — so let's have a go at a few circuits.

Simple voltage regulator

In a way, we've already touched on this theme. The basic power supply from our first episode in this series used a 7805 5V one amp regulator. This tiny three-terminal regulator has a power transistor built inside, which is capable of providing 5V DC at up to 1A.

Let's say the junk box has dried up and we haven't any 7805's left. A very simple power supply can be made using just a handful of components, which will also help us understand how to pick transistors for the right job.

As you can see in Fig.1, the circuit uses a zener diode, a resistor, two capacitors and a transistor. This type of supply is known as a 'stabilised' unit rather than *regulated*, because of the fairly imprecise way the zener diode works. Be that as it may, it will be more than adequate for most circuits.

Zener diodes are rather strange devices, in that they're designed to 'break down' over and over again.

From past notes, we know that ordinary diodes allow current to flow in one direction and not the other. With a zener diode, current flows in one direction and not in the other — up to a point. If you put enough reverse voltage on a zener diode, it will all of a sudden allow masses of current to flow in the wrong direction.

Once this point has been reached, more voltage means more current will flow. Drop below the threshold and the current falls. If we limit the current flow through the device by a resistor and then feed it with a higher voltage than necessary, the node point is a fairly steady voltage.

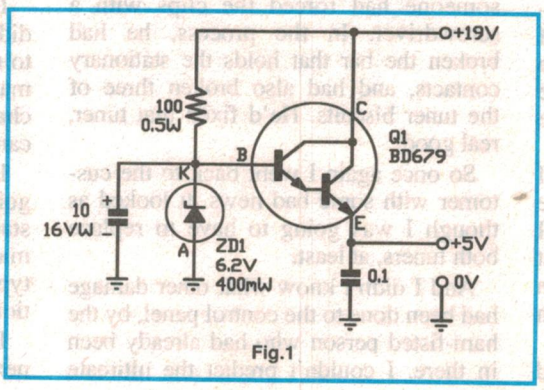


Fig.1

The good thing about this is that it's not only repeatable, but it occurs at different voltages for different devices — that's why when you look through an electronics catalog and look under zener diodes, there are so many types.

Zener diodes have two main ratings — voltage and power dissipation. The voltage rating is the voltage at which the diode breaks down and allows current to flow. The power dissipation rating is how much power the device can handle before 'giving up the ghost'. Fig.1 uses a 6.2V 400mW type. This means that we have 6.2V or thereabouts at the node point. The '400mW' means that the voltage times the current through the diode cannot exceed 400 milliwatts. Since the 6.2V is fixed, it simply means that we must limit the current to less than about 60mA. In practice though, 60mA through a diode this small would enable you to just about see it glow! Luckily in this circuit, 10mA will be more than enough.

Feeding the zener with 19V DC from a full-wave rectifier circuit and 12V AC plug pack, a 100 ohm 0.5W will do nicely and give us around about the figure we want.

The power transistor is a special type known as a *Darlington* transistor. It's actually made up of two transistors, with the emitter of the first connected to the base of the second. The benefit of this is that the gains of the two transistors are multiplied and you end up with a transistor with very high gain. If the second transistor is designed as a larger current carrying type, you then get a transistor with high gain *and* high current carrying capabilities. (The down side is that it doesn't usually have a good frequency response, but since we are dealing with DC in this case, who cares?)

The particular device used in this circuit is a common BD679 NPN Darlington. It has a current gain

(beta) of around 700 and a maximum collector current of four amps. However, its frequency response is quite low — around 100kHz if you're lucky. When you take into account the 6.2V zener diode and the 1.2V drop across two base-emitter junctions, the emitter will be at pretty close to 5V.

Using the beta figure of 700, the 10mA of current available for the base is enough for the transistor to control up to 7A, or enough to blow it up — so we have enough base current. What we need to consider now is power dissipation.

When you first start out playing with electronic circuits, one of the most useful lessons comes from blowing up a device — preferably a cheap one. No, seriously! I won't tell you how, since most people manage to do it without instructions (yours truly included!) The reason is that there is a characteristic smell of burning plastic which is always present when a device is about to snuff it.

Power dissipation is where many people run into trouble. Let's say that our load circuit requires 5V DC at 1A. The power transistor will have 5V on its emitter and 19V (worst case) on its collector. The difference — i.e., 14V — is across the transistor. Couple that with 1A of current flowing through it, and you end up with 14W (watts) of power dissipation.

Without a heatsink, the circuit will last about 20 seconds before the smell and smoke begin wafting through the air. A good-sized heatsink draws the heat out of the transistor, keeping it cool — and keeping it running. If you look up the specifications for the BD679 (which you can find in the back of most catalogs), you'll find that it can handle around 40W of dissipation — with a suitable heatsink. Without a heatsink, the device would be pushing to dissipate two watts safely.

The simple rule is the bigger the heatsink, the closer you can get to the device's maximum power rating. But of course there are some practical limits, particularly if you trying to squeeze the project into that favourite little box.

Now while this is a fairly simple and brief explanation of the topic, if there is enough interest we can go through this exercise in detail, including how to work out the best heatsink to use.

Power supply projects are potentially hazardous and require a good deal of caution. While this circuit is simple, it doesn't have any short circuit protection, so if the load is a 'dead short' then you'll very likely not only zap a power transistor, but also put your plug pack under great strain — so it may snuff it as well.

The 7805 circuit presented previously has thermal protection built in so that if it gets too hot, it automatically shuts down. This is obviously the preferable option. Of course, you can make a transistor power supply with short circuit protection, too...

No zener diode?

You'll probably find this hard to believe, but guess which other component can be used in place of a zener diode? Amazingly, small-signal transistors exhibit the zener breakdown effect.

Well, after all, the base-emitter junction is a diode in itself. BC547/8/9 and BC557/8/9 types can be used as low-power zener diodes, the only trick being that the breakdown voltage will be different for each device. But it's most often less than 10V. The circuit in Fig.2 shows how to do it. As you can see, the base-emitter diode of the transistor is connected as if it were a zener diode, with the collector allowed to float.

Because the transistor wasn't designed to be a zener diode, there's no way of telling before you build the circuit what the voltage will be. All you need though, is a voltmeter to find out. It's a handy bit a knowledge to have and you'll be surprised when it can come in handy!

Another feature of the zener breakdown effect is that it is electrically noisy. Amplify that noise enough and feed it into your stereo, it will sound like your TV when it isn't set to a station. Noise generators are the basis for many sound effect projects, including steam train chuffing and whistles, beach surf, rain and wind.

The circuit in Fig.3 is a very common one and can form the basis of many other noise generation projects. The noise from transistor Q2 is taken from the reverse biased emitter junction and AC coupled to a simple single transistor amplifier using Q1. The only rule with this circuit is that because of the zener action, you'll need around 12V minimum for the supply rail — too much less than this and you won't get any noise at all.

Drill speed control

With two small signal transistors and one power type, you can make a simple but useful drill speed control which demonstrates another circuit area, known as *pulse width modulation* or 'PWM'. The circuit in Fig.4 uses this technique to create an efficient PCB/model drill speed control that runs on pulses of electricity.

The theory of PWM is quite involved, but it can be simplified like this. A pulse waveform can be converted to an analog voltage by using a simple resistor/capacitor filter. By changing the *duty cycle*, or the high-to-low ratio of the waveform, you can change the filtered voltage.

Frequency is not critical here, but the duty cycle is. A small duty cycle converts to a low voltage and vice versa. This conversion process is known as integration, from the mathematical principle.

If you hate maths, then don't worry — in this case the motor inside the drill actually does the maths for you!

The circuit feeds a high frequency pulse waveform, with a varying duty-cycle, to the drill. Now the motor is too slow to react to each individual pulse, so it effectively averages out or 'integrates' the pulses into a DC voltage. In effect, the motor acts as a filter.

There are a number of benefits to PWM control. The first is efficiency. Because the power transistor is either turned on or off, it acts like a switch

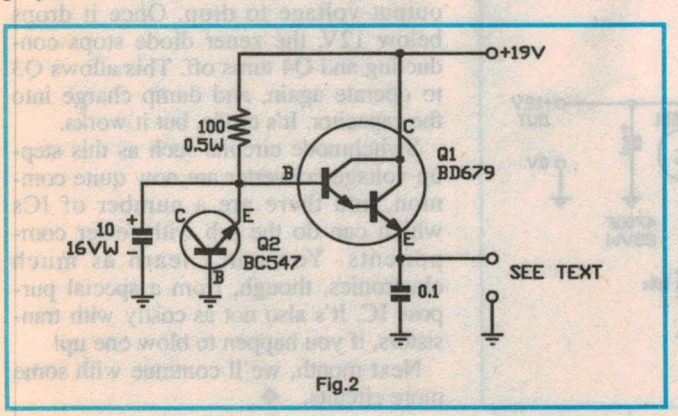


Fig.2

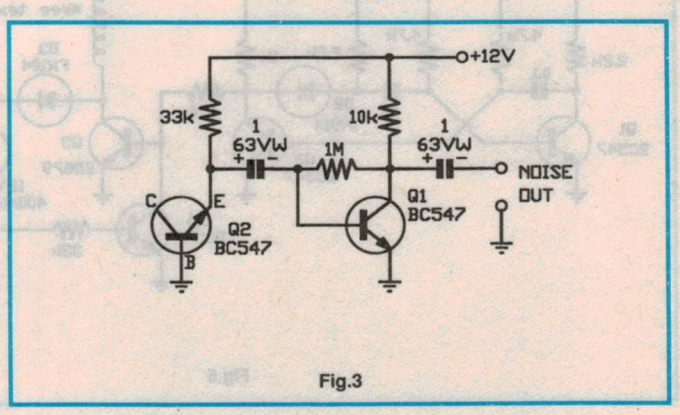


Fig.3

and therefore dissipates little heat — in other words, it wastes little energy. Secondly, the motor works much better at low revs than with a standard variable DC power supply, and provides a much smoother operation.

You've probably noticed the extra diode in the two-transistor oscillator section. This diode allows the transistor to switch on and off faster, to give a much shorter rise time, which is ideal for pulse waveform circuits. This is a not-so-common improvement over the original circuit we presented a couple of months ago. While it's not quite so critical in this circuit, it's worth having around in your circuit files because it can greatly improve the transistor's rise and fall times at the cost of only a diode and resistor.

The benefit of this addition to the circuit is that the reduced rise and fall times improve the control of the output transistor, and also slightly reduce its power dissipation during the voltage transitions.

An example of where PWM is of major benefit is with model trains. There is nothing more realistic than seeing a model loco pull away smoothly from a station, and this can be easily achieved with PWM control.

You could use the circuit of Fig.4 as a simple train controller, but because it doesn't have any feedback, you will notice speed changes with heavy loads. The same can be said for using it as a speed control for drills as well.

12V supply from 6V?

One of the areas of electronics that fascinated me from the start was voltage converter circuits. The fact that you can take a 6V battery, feed it through a circuit and end up with more volts than when you started seemed a little on the 'alchemy' side of science. However, it's easy to confuse energy and voltage, when you're just starting out...

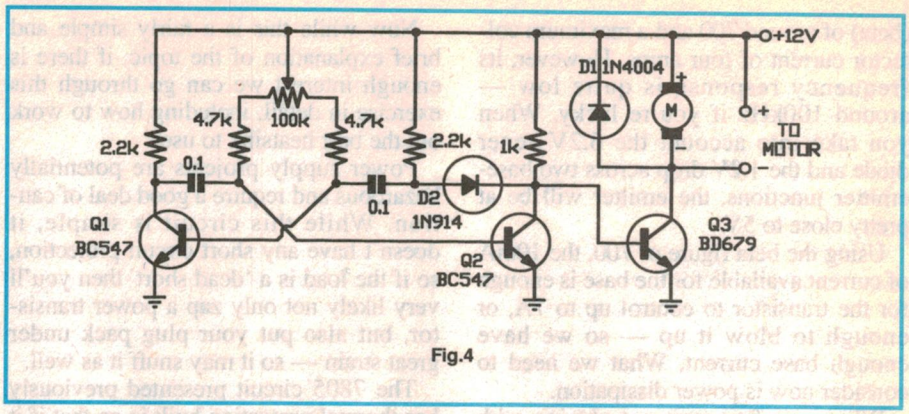


Fig.4

Pulse-width modulation leads into an area of power electronics which has taken over in the last 20 years, and that's switchmode power design. If you have a video camera, the odds are that it came with a power supply. If you read the manufacture plate, you might find that the AC input voltage to the supply could be anywhere from 80 to 275V AC, but still provide a perfect 6V or 9.6V DC for your camera. Supplies such as this are invariably switchmode designs.

Switchmode design is offered as a specific course in electronic engineering degrees, so it's a bit beyond the scope here to explain fully. But by using a handful of devices, we can create a practical 12V DC supply capable of supplying 100mA from a 6V battery. The circuit appears in Fig.5.

Again, we start off with our two transistor oscillator (told you it was a handy little circuit!). But the device that actually 'creates' the extra voltage is simply made up of wire. You'll need to wind 50 turns of 0.5mm diameter enamelled copper wire around a 30mm outside diameter toroidal ring core, and you make an inductor (L1). Make sure your 'turns' are neat and are firmly gripped around the core — this makes a better inductor.

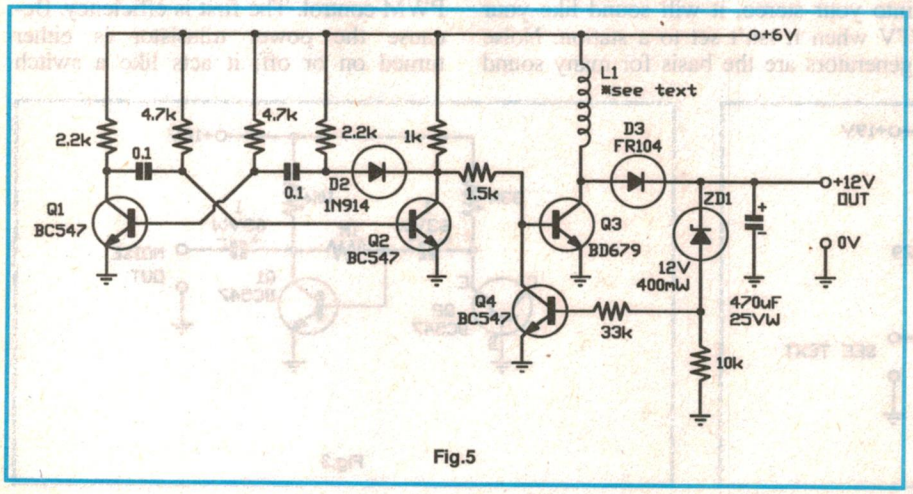


Fig.5

Inductors are storers of energy, and this storage occurs whenever current flows through it. Cut off that flow however, and the inductor tries to maintain it by increasing its voltage.

That voltage can rise to many times above that of the circuit supply — albeit very briefly. Do it often enough though, and with a little help in terms of direction, that energy conversion into voltage can be stored in a capacitor and used to power higher voltage loads.

Here our switching transistor Q3, driven by the Q1-Q2 oscillator, switches the current on and off through inductor L1. Each time the transistor turns off, the high voltage 'blip' created by L1 is fed through switching diode D3 and used to charge up the 470uF output 'reservoir' capacitor, to around 12V.

A typical application of this kind of circuit is running a 12V car cassette player from an old 6V Volkswagen. This circuit can't supply the sort of power required to run a car stereo, but it will give you the idea behind the principle. We may look at a more powerful and more efficient way of doing this at a later stage.

Looking back to the circuit, the 12V zener diode in the output stage provides a very crude form of voltage regulation. Once the voltage across the 470uF reservoir capacitor reaches 12V, zener diode ZD1 begins to conduct and transistor Q4 turns on, starving the driver transistor Q3 of current. So Q3 shuts off, allowing the output voltage to drop. Once it drops below 12V, the zener diode stops conducting and Q4 turns off. This allows Q3 to operate again, and dump charge into the capacitor. It's crude, but it works.

Switchmode circuits such as this step-up voltage converter are now quite common, and there are a number of ICs which can do the job with fewer components. You can't learn as much electronics, though, from a special purpose IC. It's also not as costly with transistors, if you happen to blow one up!

Next month, we'll continue with some more circuits. ❖

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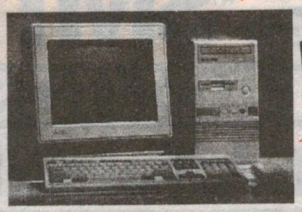
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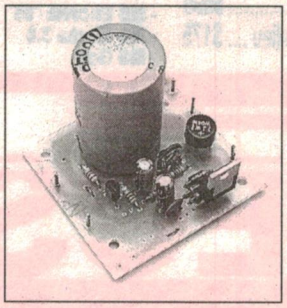
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Max. Power output at 10% THD
Stereo: 1W/ch into 8 ohm at Vcc=9V
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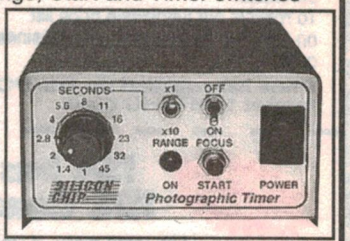
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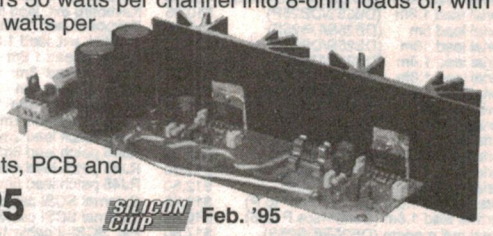
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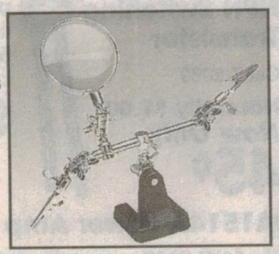
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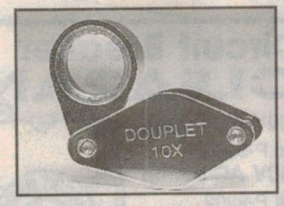


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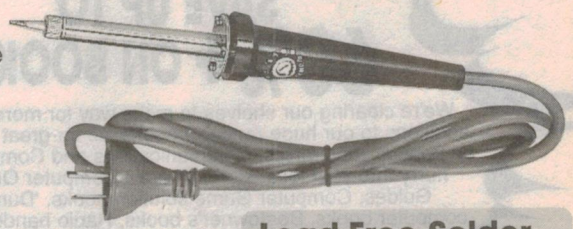


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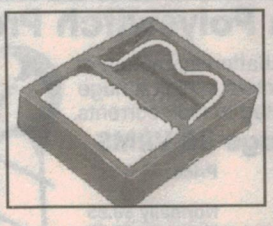


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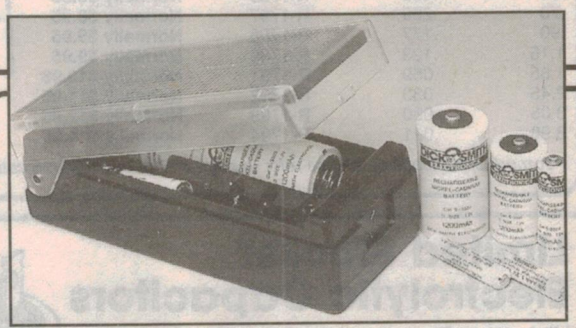
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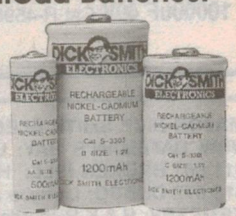
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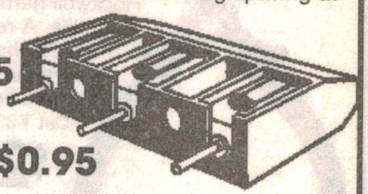


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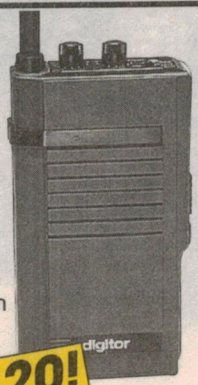
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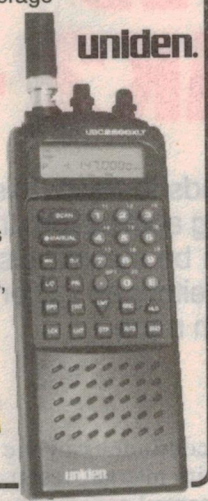
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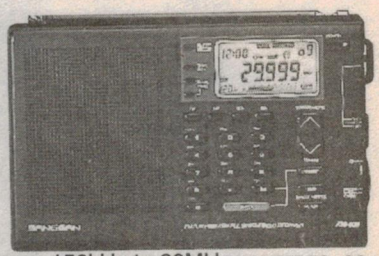


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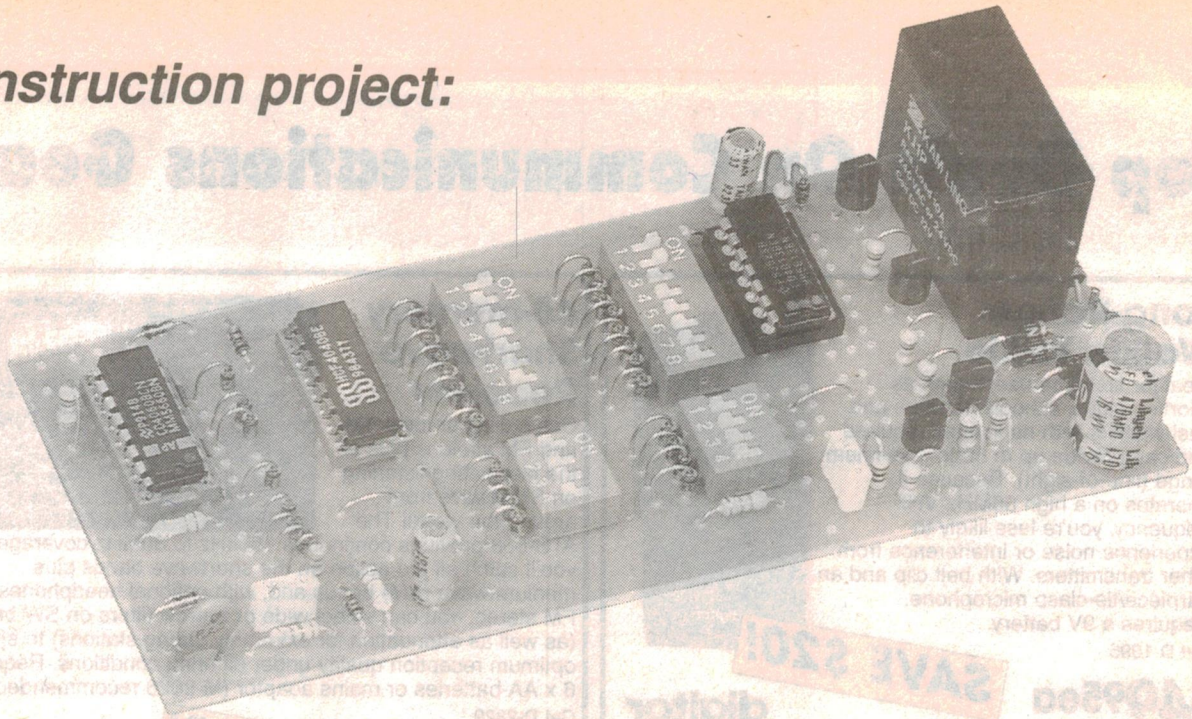
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by ROB EVANS

In the March 1991 issue of *Electronics Australia* we presented a simple, yet versatile timer circuit based on just two ICs which we dubbed the 'Flexitimer' — because of the flexible nature of the circuit. It could produce a wide range of delay times, and in its basic form would energise a relay or some other device at the end of this period.

While a large number of Flexitimers have been built by constructors since that time (it's still available as a kit), many readers have suggested that an even more versatile timer circuit is needed. This is perhaps because without modification, the Flexitimer can only produce one timed event, in a 'single shot' manner, and was not really designed so that this aspect is easy to change.

On the other hand, if you did alter the circuit to run in a continuous cyclic mode (by disabling its internal reset), you then had no real control over the on-to-off timing ratio — or mark-to-space ratio, if you like. So as useful as it is, the original Flexitimer circuit is perhaps not quite flexible enough...

As you've no doubt gathered, this has led us to develop a new and much improved timer circuit, which for want of a better name we've called the Flexitimer Mk2.

Like its predecessor the new Flexitimer is a relatively small unit which uses common low-cost parts, and can be built up to perform a wide range of timing tasks.

The similarity tends to end there however, since as well as solving the shortcomings of the original circuit the new unit can be accurately 'programmed' to produce two independent time periods. It can also be set to a single or cyclic mode, and is able drive a range of output devices.

We've also included facilities for programming the delay times via DIP switches, and added an output 'matrix' on the PCB so that wire links can be used to set which parts of the timer control the output devices.

And finally, we've also taken considerable effort to make sure that it's relatively easy to set up the Flexitimer for a given application, since as you can imagine, this type of 'open ended' circuit often presents just *too* many alternatives at a time — option overload, you could say!

In short, we feel confident that the new Flexitimer Mk2 will be able to complete just about any timing task that comes along, thanks to the very flexible nature of both the design and the PCB arrange-

ment. You *could* say that its name is more applicable than ever...

The basic circuit

As the new Flexitimer's circuit can be configured in a number of ways, depending upon the job you have in mind, we've elected to show *two* schematic diagrams (Fig.1 and Fig.2) which demonstrate a couple of basic arrangements for the timer. By noting the way each circuit uses the Flexitimer's options, it should be clear how to re-arrange things for a host of other timing circuits — see later for more detailed information on this.

Fig.1 shows a simple battery powered unit which might be used as a games timer, or in situations where timing accuracy is not overly critical and a compact low-powered design is called for. This is a 'single-shot' timer, and with the components shown, will illuminate LED2 after 60 seconds — indicating that the time period has elapsed. Before this occurs however, LED1 will illuminate for around seven seconds (commencing at 53 seconds), which acts as a warning that the overall time period has almost elapsed.

When used as a games timer for example, this warning period alerts the player that their allotted time is about to expire (quick, do something!), and can even enhance the excitement of more demanding games. You could fit audible buzzers in place of either or both LEDs, which would certainly raise the interest (read: tension) levels during the game.

Getting back to the circuit itself, this can be considered as three distinct sections; the master oscillator/divider based on a 4060 CMOS 14-stage counter (IC1), the main timing divider formed by a 4040 CMOS 14-stage counter (IC2), and the output switching stage which is controlled by the 4013 D-type flipflop IC3a. The circuit's operation is quite straightforward, and the more elaborate versions of the Flexitimer use the same basic idea.

In this case, the timer's master clock is based on the 4060's internal clock circuitry which is accessed via pins 9, 10 and 11 of IC1, and is set to a frequency of 614.4Hz by components R1, R2 and C2. The 4060's Q8 output (divide by 512) is then used to clock the following 4040 counter (IC2) at a clock rate of 1.2Hz. This rate is further divided by IC2, where its outputs are used to both set and reset the output latch (IC3a).

Note that both IC1 and IC2 are forced into a reset state when power is first applied, thanks to the power-on reset circuit based on C3, R5 and D15.

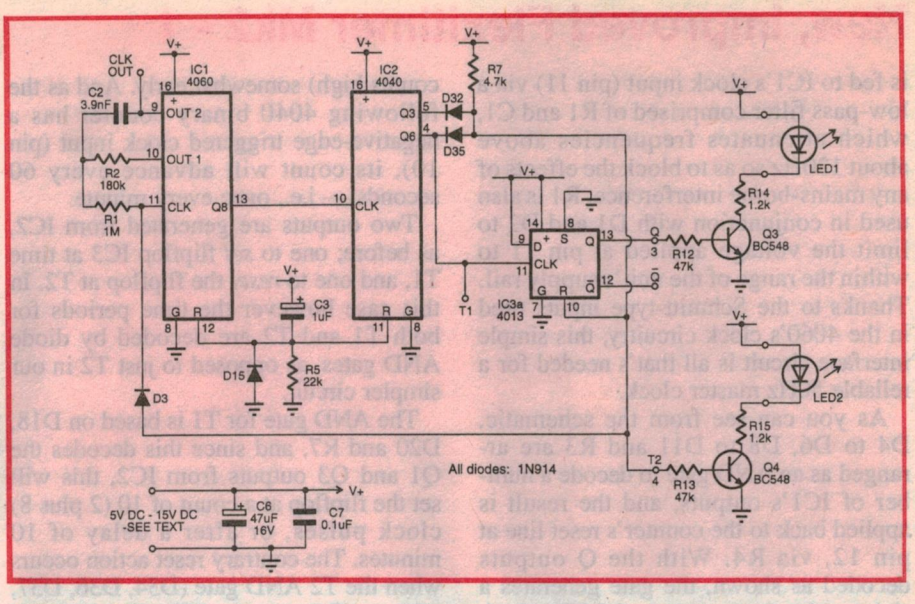


Fig.1: The Flexitimer's circuit when set up as a simple battery powered games timer, with an elapsed time warning indicator, LED1.

Since the Q6 output from IC2 will divide its clock rate by 128 and will therefore go high at a count of 64, the positive-edge triggered 4013 flipflop (IC3a) will be 'clocked' (at pin 11) after 53 seconds has elapsed — 1.2Hz has a period of 0.833 seconds, and 64 of these periods is 53.33 seconds. The high level at IC3's D input (pin 9) is then passed to the Q output at pin 13, which in turn biases Q3 hard on via R12, thereby energising LED1 through limiting resistor R14.

The circuit remains in this state for the next seven seconds, until both Q6 *and* Q3 of IC2 go high at a count of 72. That is, 64 counts for Q6 plus 8 counts for Q3, which is a total of 60 seconds (72 x 0.833).

As *both* D35 and D32 are now reverse biased, R7 will pull their anodes to a high level in a simple AND gate fashion. This 'decoded' output then triggers the flipflop (IC3a) back into its reset state via the reset line at pin 10, and LED1 turns off. Note that the output of the AND gate also drives LED2 via R13, Q4 and R15 to indicate that the overall time has elapsed (60 seconds in this case). It also drives diode D3, which is used to disable the master clock at pin 11 of IC1 so all counting stops — remember that this is a 'single-shot' configuration.

The remaining components, C6 and C7 are used to bypass the unit's main supply rail Vcc, while the DC input voltage (labeled V+) powers LED1 and LED2 directly. Note that while the CMOS chips have a possible supply voltage range of 3V to 18V, we'd suggest that you play it safe and stick to a range of 5V to 15V — bear in mind that we've specified the main filter capacitor (C6) as a 16V-rated device.

So in practice we have a circuit with two distinct timing 'events'; T1 and T2, which set and reset the output flipflop, respectively. These events can be programmed to occur over a wide range of time periods by selecting IC1's master clock rate and output division, and of course, which single or decoded outputs are used from IC2.

As IC1 and IC2 are reset at power-on, a timing cycle is initiated by applying power to the circuit. The circuit has a nominal current drain (LEDs off) of less than 5mA, by the way.

More complex circuit

The circuit shown in Fig.2 demonstrates how the new Flexitimer can be arranged as an accurate long-term timer with (again) fully programmable event times. In this particular case our general circuit is configured to run in a *cyclic* mode, where the output relay is energised for 10 minutes in every 24 hours.

Rather than IC1's master clock being based on an RC oscillator as was the case with our simple circuit, Fig.2 shows how the 4060 can be clocked from the 50Hz mains signal appearing at the unit's AC input — which as you would expect, is driven by a power transformer's low-voltage secondary winding. This is an attractive proposition for long-term timing circuits, since while the mains frequency has an fairly poor *short-term* frequency stability, its accuracy over a long period (say 24 hours or more) is very good indeed.

The 50Hz signal from the AC input

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is fed to IC1's clock input (pin 11) via a low-pass filter comprised of R1 and C1, which attenuates frequencies above about 130Hz so as to block the effects of any mains-borne interference. R1 is also used in conjunction with D1 and D2 to limit the voltage applied at pin 11 to within the range of the unit's supply rail. Thanks to the Schmitt-type inputs used in the 4060's clock circuitry, this simple interface circuit is all that's needed for a reliable 50Hz master clock.

As you can see from the schematic, D4 to D6, D8 to D11 and R3 are arranged as an AND gate to decode a number of IC1's outputs, and the result is applied back to the counter's reset line at pin 12, via R4. With the Q outputs decoded as shown, the gate generates a rising edge at a count of 3000 clock cycles, thereby resetting the counter every 60 seconds — 3000 x 0.02 seconds (the period for 50Hz).

By tapping off the output at Q11 as the clock for the following stage (IC2), we have a waveform that stays low for 2048 counts then goes high for 952 counts — a total clock period of 3000 counts.

Another way to look at it is that we're using the Q11 output, but the decoding AND gate just terminates its normal 4096 count cycle (2048 low then 2048 counts high) somewhat early. And as the following 4040 binary counter has a negative-edge triggered clock input (pin 10), its count will advance every 60 seconds — i.e., once every minute.

Two outputs are generated from IC2, as before; one to *set* flipflop IC3 at time T1, and one to *reset* the flipflop at T2. In this case however the time periods for both T1 and T2 are decoded by diode AND gates, as opposed to just T2 in our simpler circuit.

The AND gate for T1 is based on D18, D20 and R7, and since this decodes the Q1 and Q3 outputs from IC2, this will set the flipflop at a count of 10 (2 plus 8) clock pulses, or after a delay of 10 minutes. The contrary reset action occurs when the T2 AND gate (D34, D36, D37, D39 and R6) decodes IC2's Q outputs as shown — which works out as a time of 1440 minutes, or exactly 24 hours (32 (Q5) + 128 (Q7) + 256 (Q8) + 1024 (Q10) = 1440).

Unlike the basic circuit though, we've used IC3a's Q-bar (rather than Q) output at pin 12 to drive the load, which in this case is relay RLA1 via NPN transistor Q1 and base limiting resistor R10. So RLA1 will be energised for the first 10 minutes of counting (T1), then will stay off until an overall time of 24 hours (T2) is reached. Note that we have a power-on reset circuit as before (plus isolating diodes D14 and D16), and this forces both IC1 and IC2 to start from a count of zero.

Since this circuit is configured as a continuous or cyclic counter, IC2 is reset at T2 (24 hours) so that the process is repeated. This is achieved by the differentiating circuit formed by C4, R9 and D46, which passes the rising edge at IC3a's Q-bar output to IC2's reset line at pin 11, via isolating resistor R8.

Note that a similar time sequence could be achieved by setting T1 to 1430 (rather than 10) minutes, and using IC3a's normal Q output. The only difference would be that when power is first applied, the relay would stay *off* for 23 hours and 50 minutes (T1), then turn *on* for 10 minutes, with the cycle repeating every 24 hours (T2). So in practice, the real change is that the repeating cycle does not *start* with a 10 minute 'on' period as before. As we said, this is a very flexible timer circuit...

The remaining parts of the circuit in Fig.2 include the power supply components, and the 'free' switching transistors Q2 to Q4. The latter are available for other switching jobs, such as LEDs, buzzers, opto-isolators, extra relays and so on, and can be connected to various

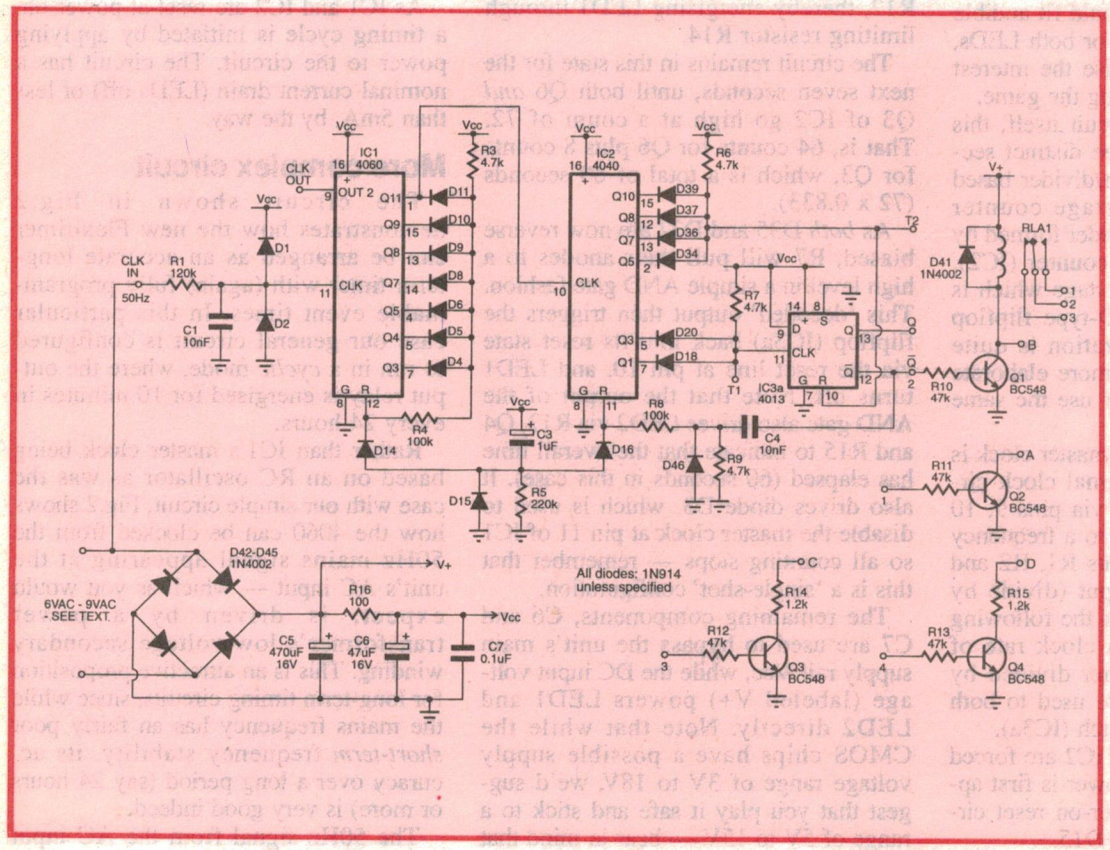


Fig.2: Here, the Flexitimer has been configured as an AC powered, long term continuous timer, where the timing is synchronised by the 50Hz mains and a relay is used at the output. Note the diode AND gates used at the outputs of IC1 and IC2.

points around the circuit, depending upon your application.

As you can see, Q2 is arranged as an 'open-collector' switch in the same manner as Q1, and is driven via base resistor R11 which has a connection point designated as input 1. Q3 and Q4 have base resistors R12 and R13 (for inputs 3 and 4), and collector resistors R14 and R15, all respectively, and are intended for low-voltage loads such as LEDs or other semiconductor devices.

Finally, the power supply as shown is intended for an AC source and consequently uses a full wave rectifier formed by power diodes D42 to D45, and main reservoir capacitor C5. With a 9V AC input this generates a DC supply of around 12V, which is passed to the relay switching circuit as V+. This rail is further filtered by the combination of R16 and C6, plus bypass capacitor C7, and is then used to supply the main low-powered parts of the circuit as Vcc.

Configuring it

Despite the large number of ways in which the circuit can be setup, once you've made the broad decisions on how the timer will be used, the configuring process should be fairly straightforward. To help you along with this task we've included a considerable number of labels on the component overlay diagram, and these show all likely connection points, plus the count division associated with each of the possible AND gate diodes.

But don't be too concerned by the large number of components drawn on the overlay diagram, since we've elected to show this with all of the options included. For example, the parts for *both* the RC and 50Hz clock configurations appear — in practice, your timer's PCB will not be as highly populated.

Perhaps the best way to show how the Flexitimer is configured is by way of a few examples, since as you might imagine, detailing all of the possible arrangements would be an exhausting (and perhaps futile) task. And in practice there are a few broad, but well-defined ways in which timers are mostly used.

Imagine for our first example that you wish to create a garden watering timer that controls the 24V power applied to a water solenoid, and this must be activated for say 15 minutes every 12 hours. As the Flexitimer will therefore need both the output switching relay and a reasonably accurate timing cycle, an AC powered unit with a long timing period is really needed — such as that shown in Fig.2.

Once this decision has been made, the next step is to consider how much control (if any) you will need over the 'on' and 'cycle' times of the system. It would be likely that while the repeat (cycle) time would always be 12 hours, the on (watering) time may need to be varied from the nominal 15 minutes. The answer here is to fit DIP switches on the circuit board for controlling just that event time.

If the circuit is setup as shown in Fig.2 (using the flipflop's Q-bar output), time period T1 will directly control the actual watering duration (15 minutes) and the DIP switches should therefore be installed in the 'EVENT 1' position on the board — with their associated diodes, of course. Since we have a one minute clock cycle, the switches can be set for a binary total of 15 (1+2+4+8) as indicated on the component overlay diagram, then 'fine-tuned' at a later stage.

Note that you would not really need to install the four-way DIP switch in the EVENT 1 position, since the eight-way switch alone gives you a possible on-time of up to 255 minutes in one minute steps. On the other hand if you elect *not* to fit the DIP switches for controlling EVENT 1 (or time T1, if you like), diodes D17 to D20 just need to be installed, since these correspond to counts of 1, 2, 4 and 8.

However, in this situation you can see the temptation for changing the on-time to 16 minutes — as this corresponds to just *one* counter output (Q4). And since an AND gate is then not required, the matching diode (D21 for a 16 count) can be replaced by a link.

The EVENT 2 timing in this example is a straightforward decoding exercise, where the diode positions are selected for a count of 720 (12 hours), and the DIP switches are not used. In practice, this corresponds to diodes D38, D36, D35 and D33, which select the counts of 512, 128, 64 and 16, respectively.

As the relay is likely to have a coil rated for 12V operation, you would need a power transformer with a 9V AC secondary winding in order to generate a suitable DC supply for the unit (V+). In our experience however, most 12V relays are happy to operate when just 9V is applied to the coil, so the more common transformers with a 6.3V AC secondary should be quite suitable — a low-cost 2851 type, for example.

For the proposed watering timer though, a transformer to power 24V AC solenoids is likely to be accessible, and it would be desirable to use this AC source to power the Flexitimer. In this case the best bet may be to develop a 12V DC supply from this source, using some kind of external rectifier and voltage regulator. The 50Hz clock signal applied to R1 could come directly from the 24V AC winding however, since the 4060's clock input is well protected by D1 and D2 in conjunction with R1.

If you would like to have some kind of active indication that the unit is operating, one of the spare output switching transistors could be used to flash a LED at a convenient clock rate. If input 3 at Q3 is linked to say the Q4 output of IC1 and a LED is connected between V+ and R14, the LED will pulse at around 1.3Hz.

Charging timer

A variation on the timer just described would be where the relay stays engaged for an extended period then simply shuts off, in a 'single shot' mode. This type of circuit might be used to disconnect a simple NiCad charger from its battery load after an appropriate charge time has elapsed, with a warning LED to indicate that that the cells are almost ready for use.

In this case the cycling reset components C4, R9, D46 and R8 are not needed, but diode D3 should be installed to freeze the count at the end of the timing period (EVENT 2 at time T2). Note that D3's clock-inhibit action works equally well with the 50Hz mains driven clock shown in Fig.2.

Unlike that circuit though, the relay switching transistor Q1 (input 2) should now be driven from the EVENT 2 AND gate, so that the relay is normally off and will be engaged at the *end* of the timing period (T2). As the NiCad charger's output would then be wired though the relay's normally closed contacts, the idea here is that the charger will work normally with the timer switched off, and if a charging timeout *is* needed then you just apply power to the timer itself. And as current is not normally flowing through the relay coil, the timer is more power efficient with this arrangement.

As the charger output is to be disconnected after an appropriate delay period (say 10 hours), the timer's EVENT 2 gate will need to be set so that T2 goes high at a count of 600 minutes (512 + 64 + 16 + 8). We can then organise the flipflop to be set (by T1) at a count of say 536 (512 + 16 + 8) and connect an indicator LED circuit to its Q output, as shown in Fig.1 (see R12, Q3, R14 and LED1).

The timer will then activate an 'almost finished' LED during the last hour (64 minutes, in fact) of the charge period, then simultaneously disconnect the charger's load and shut off the warning LED. You could also connect another

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LED circuit to the T2 point, as also shown in Fig.1 (LED2), to provide a 'charging completed' indicator.

If the proposed charger shutoff timer was to be run with a 12V DC system, as is the case when (say) fast-charging model car battery packs from a automobile battery, the mains-synchronised (50Hz) clock is clearly not an option.

Here, the answer is to use an RC clock system as shown in Fig.1, which could be set to 50Hz or more conveniently, to 614Hz using the suggested values for C2, R2 and R1. Then by choosing IC1's Q11 output rather than Q8, IC2 would be clocked at a rate of 0.15Hz (614.4 divided by 4096), thereby allowing the circuit to be set for a timeout of up to 288 minutes in steps of 6.7 seconds. Due to tolerance variations in the value of the key oscillator components C2 and R2, these frequencies and periods would be slightly different in practice, however.

While the timing accuracy is not really critical in the above application, there may be occasions where a more reliable time span is needed. To cater for this situation we've arranged the PCB pads around R2 so that a miniature (vertical mounting) trimpot can be installed in place of R2, and the clock frequency fine-tuned once the timer is completed — the trimpot is depicted as a dashed outline on the overlay diagram.

To calculate the theoretical values of C2 and R2 for other clock frequencies, you can use the simple equation suggested in the 4060 IC's data sheets, where the frequency equals the inverse of (C2 x R2 X 2.3). While this yields a result of 619Hz for the above example, the equation should only be used as a guide for choosing suitable component values — it becomes rather inaccurate for large or small values of both C2 and R2.

Practical limits

While the basic Flexitimer circuit is capable of producing delays or cycle periods over a very wide range of times, its more 'user friendly' configurations tend to have a defined adjustment span. For example, the circuit shown in Fig.2 has been set up for a main divider (IC2) clock period of one minute, as this makes selecting the AND gate diodes or adjusting the DIP switch settings quite a straightforward process. If EVENT 1 is to occur at 32 minutes, just select the DIP switch marked '32' on the overlay diagram or install the corresponding diode (D22).

With a one minute clock at IC2 then, there is a maximum time setting for EVENT 1 or EVENT 2 of 2048 minutes (about 34 hours), since the 12-bit 4040's highest-order output (Q11) goes high after 2048 counts. The minimum event time will one minute, since the counter's lowest-order output (Q0) will go high after just one input clock cycle.

Extending the range

All in all, we think an adjustment range of one minute to 34 hours will suit most extended timing applications. But if you don't mind slightly odd main clock rates and a less than intuitive process for selecting the DIP switch (or diode) positions, a *very* wide range of delay times are possible.

To demonstrate this, imagine that the circuit has the RC oscillator set to a frequency of 1Hz — this is quite possible with the 4060 clock circuit — and we've selected the Q13 output of IC1, plus the Q11 output from IC2. This means that IC2 is clocked at a rate of 61 microhertz (one divided by 16384), and its Q11 output will switch to a high level after a delay of about 9321 hours (2048 x 16,384 seconds) or 388 days!

While you may be tempted to build a novelty birthday reminder that sounds a buzzer at one year intervals, remember that its accuracy would be severely limited by the nature of the RC oscillator. On the other hand, our office jester suggested that the opposing temperature variations though the summer and winter seasons may well cancel out any timing errors caused by thermal drift in the oscillator frequency!

On a more serious note though, an accurate *7-day* timer is quite a viable proposition when using the 50Hz master clock. This would be done by setting IC1 for an output clock cycle of five minutes, by configuring its AND gate for a reset pulse at 15,000 counts; then arranging IC2's event decoding to occur at 2016 counts — 2016 counts of five minutes is 10,080 minutes, or seven days.

While the above five-minute clock would use the Q3, Q4, Q7, Q9, Q11, Q12 and Q13 outputs from IC1, note that the 4060 counter does *not* offer Q0, Q1, Q2 or Q10 outputs. So despite the fact that IC1 can generate clock periods as slow as 328 seconds (directly from Q13) when using a 50Hz clock source, there will be some output periods that just can't be generated.

This doesn't seem to be too much of a problem in practice though, since the wide event decoding range at IC2 can be used to compensate for a short or long clock rate from IC1.

In summary then, the Flexitimer should be able to perform just about any timing job that you may have in mind. It can be built up with all, none or some of the DIP switches in place, can be configured for a continuous or once-off timing cycle, and can have its timing synchronised by the 50Hz mains or generated by a simple RC oscillator. And by connecting the output switching transistor circuits to key points around the board, you should be able drive all the LEDs, relays, buzzers and so on that you might need in any application.

Many readers will have noticed that while the Flexitimer uses just three ICs, the 4013 flipflop (IC3) is in fact a *dual* device and one D-type flipflop has not been used in our circuit. As you can see from the PCB layout, its input pins have been tied to ground through narrow tracks. The idea here is that these tracks can be cut, and the flipflop used to create a number of extra functions in the Flexitimer's circuit.

As space is rather short in this issue however, we plan to provide more information on how to make the Flexitimer even more versatile in the second of these articles, along with the construction details.

We'll show you how the remaining D-flipflop can be used to advantage, suggest a number of handy ways to connect the output switching circuits, and in the process, propose a couple of more productive applications for the Flexitimer.

(To be continued) ❖

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*AMD CPU, #CYRIX CPU Without Asterisk- INTEL CPU @ Come with I/O Card fitted on motherboard

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4M X 9-70 With Parity	$259	$249	$239
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260M	16ms	$242	$200
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1.27GB	10ms	$629	$520
1 GB SCSI HD	10ms	$632	$525
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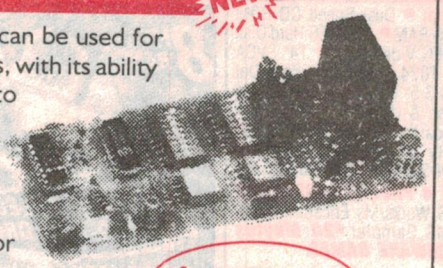
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EA **AUG'95**

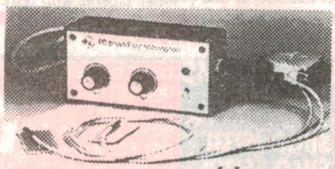


K10685 **$27.95**

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This simple project will let you take your own electrocardiograph, and display it on a PC. With the software supplied, you can read, display, save to disk and print the electrical waveform generated by your own heart (or anyone else's). Powered by a 9V battery and electrically isolated from the computer, the PC-ECG is a safe, low cost way to monitor the electrical activity of the heart

EA **JULY '95**



K10680 **$38.95**

LOW COST TRANSISTER & MOSFET TESTER

This handy tester is designed to plug into a digital multimeter to provide accurate measurement of transistor beta, to values up to 50,000 or more. You can use it to test small signal, power & Darlingtons transistors &, as a bonus, it will check Mosfets.

SC **May '95**

NEW



K10675 **$29.95**

A PHOTOGRAPHIC TIMER FOR DARKROOMS

If you are looking for an accurate way to control film developing times, then take a look at this Photographic Timer. It will switch on mains-powered fluorescent ultraviolet tubes or incandescent lamps rated at up to 1200W for a preset time ranging from 1 - 450 seconds.

Silicon Chip April '95

K10665 **$64.95**

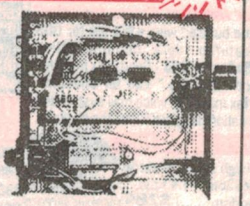
NEW



ECONOMY SURROUND SOUND DECODER NEW

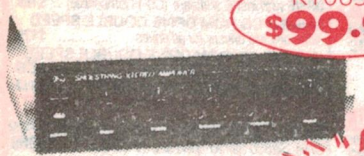
Perhaps your budget can't quite stretch to the cost of a full "bells and whistles" Dolby Pro-Logic surround sound decoder. Or alternatively, you might be one of those music lovers who doesn't like the idea of subjecting your favourite music to a lot of fancy digital processing. Either way, this really low cost Halfer-type analog decoder should appeal to you.

EA **May '95** K10670 **$59.95**



A BUDGET PRICED "SHOESTRING" STEREO AMP

K10650 **$99.95**



GREAT VALUE! IDEAL FOR SCHOOL PROJECT OR MULTIMEDIA.

NEW

With a power rating of around 15 watts per channel and impressive noise and distortion performance, this new low cost amplifier is ideal for small hi-fi systems, "home theatre" installations, and a host of other applications. It uses readily available parts, offers a basic range of features, and is very easy to put together. Ideal for school. College or University project or built to work as a computer multimedia amplifier. **EA Dec'94**

DIGITAL TRIGGER ADAPTOR FOR SCOPES

K10660 **$68.95**



With eight inputs (expandable to 24), this useful device will monitor almost any digital circuit and trigger your oscilloscope only when a preset combination of inputs is found. It also includes an adjustable triggering delay, so it can effectively convert your scope into a low cost logic analyser. EA ***April '95***

KITS KITS KITS KITS KITS KITS KITS

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K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
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K10105	3 DIGIT COUNTER	$22.95
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K10115	ELECTRIC FENCE CONTROLLER	$61.95
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K10160	THERMOSTATIC SWITCH FOR RADIATOR FANS	$31.95
K10165	I/O ADAPTOR FOR PC's	$59.95
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K10175	LOW COST SIG. TRACER/AMP	$69.95
K10180	STEREO FM TRANSMITTER	$33.95
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K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10260	INVERTER 2KW (NON ASSEMBLED)	$1,495.00
K10265	INVERTER 2KW ASSEMBLED & TESTED	$1,895.00
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K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
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K10440	HIGH EFFICIENCY FLUORO INVERTER KIT	$49.95
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K10460	VERSATILE 40V / 3A LAB POWER SUPPLY	$165.95
K10470	CHAMP 0.5 WATT AMPLIFIER	$9.95
K10475	90 SECOND MESSAGE HOLDER	$97.95
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W12616 -16way	$1.75	$1.50	$1.20
W12620 -20way	$1.95	$1.75	$1.40
W12624 -24way	$2.25	$1.95	$1.50
W12625 -25way	$2.25	$1.95	$1.50
W12626 -26way	$2.50	$2.10	$1.90
W12634 -34way	$2.95	$2.50	$2.10
W12636 -36way	$3.10	$2.70	$2.20
W12640 -40way	$3.50	$2.90	$2.40
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PN100: a NPN general purpose medium power amp and switch with continuous collector current up to 500mA. PN200: a PNP general purpose amp at collector currents to 1 AMP. Both are TO-82 plastic package.

PN100 REPLACES:
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PN200 REPLACES:
PN2907, PN2907A, PN3638, PN3638A, PN3640, PN3644, PN4121, PN4143, PN4248, PN4249, PN4250, PN4355, PN4916, PN4917, PN5910, 2N205A, 2N3467, 2N3702, 2N3906, 2N4125, 2N4126, 2N4291, 2N4402, 2N4403, 2N5086, 2N5087, 2N5447.

PN100.....T90001
PN200.....T90002

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$0.20	$0.18	$0.15

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H10124 195 x 113 x 60mm	$4.95	$ 4.25



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Z10105 IN4002	$0.06	$0.05	$0.04	$0.03
Z10107 IN4004	$0.08	$0.06	$0.05	$0.04
Z10110 IN4007	$0.10	$0.07	$0.06	$0.05
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Z10119 IN5408	$0.20	$0.16	$0.15	$0.14

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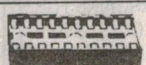
Size AA 450mmAH

1-9	10+	100+
$2.95	$2.75	$2.50

Size C 1.2 A H
$9.95 $9.50 $8.95

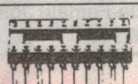
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P10560 14pin	20¢	18¢	12¢
P10565 16pin	20¢	18¢	13¢
P10567 18pin	30¢	25¢	16¢
P10568 20pin	35¢	30¢	22¢
P10569 22pin	35¢	30¢	23¢
P10570 24pin	35¢	30¢	24¢
P10572 28pin	45¢	35¢	25¢
P10575 40pin	50¢	37¢	27¢



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These quality 3 level wire wrap sockets are tin plated phosphor bronze.

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P10587 18pin	$1.95	$1.80
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P10592 22pin	$2.95	$2.70
P10594 24pin	$3.95	$3.50
P10596 28pin	$3.95	$3.50
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D TYPE IDC PLUGS



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DA15P 15pin plug P12168	$2.95	$2.50	$2.20
DB25P 25pin plug P12170	$4.50	$3.95	$3.50

D TYPE IDC SOCKETS



	1-9	10+	100+
DE9P 9pin socket P12167	$2.95	$2.50	$2.20
DA15P 15pin socket P12169	$2.95	$2.50	$2.20
DB25P 25pin socket P12171	$4.50	$3.95	$3.50

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Description	1-9	10+
2155 240V 6-15V 1A M12155	$9.95	$8.95
2156 240V 6-15V A2 M12156	$13.95	$12.95
2851 240V 12-6V CT 250mA M12851	$7.95	$6.95
6672 240V 15 30vc 1A tapped M16672	$14.95	$12.95

TOGGLE SWITCHES



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S11010 S.P.D.T	$1.20	$1.10
S11020 D.P.D.T	$1.30	$1.20

ICB VOLTAGE REGULATORS



Description	1-9	10+	100+
7805UC	$1.00	$0.90	$0.75
7812UC	$1.00	$0.90	$0.75
7815UC	$1.00	$0.90	$0.75
7905UC	$1.00	$0.90	$0.75
7912UC	$1.00	$0.90	$0.75
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78L05	$0.40	$0.30	$0.28
78L12	$0.40	$0.30	$0.28
LM324	$1.00	$0.90	$0.80
555	$0.60	$0.55	$0.50
741	$0.75	$0.65	$0.60

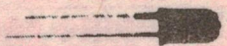
PC BOARD HOLDER



A must for all PCB work.

T12444 $9.95

QUALITY 3mm LEDS



	1-9	10-99	100+	1K 1000+
Z10140(R)	$0.15	$0.12	$0.10	$0.08
Z10141(G)	$0.20	$0.18	$0.15	$0.12
Z10143(Y)	$0.20	$0.18	$0.15	$0.12
Z10145(O)	$0.20	$0.18	$0.15	$0.12

QUALITY 5mm LEDS

Z10150(R)	$0.15	$0.12	$0.10	$0.08
Z10151(G)	$0.25	$0.20	$0.18	$0.12
Z10152(Y)	$0.25	$0.20	$0.18	$0.12

DB25 CONNECTOR SPECIALS



	1-9	10+	100+
P10880 DE9P	$0.80	$0.70	$0.60
P10885 DE9S	$0.80	$0.70	$0.60
P10891 DA15S	$0.90	$0.70	$0.60
P18092 DA15C	$0.90	$0.90	$0.60
P10895 DA15S	$1.00	$0.80	$0.60
P10902 DB25C	$1.00	$0.80	$0.60
P10904 DB25P	$1.00	$0.80	$0.60
P10905 DB25S	$1.00	$0.80	$0.60

16550 UART

Features of the UART include programmable data, format parity, framing and overrun error detection etc.



	1-9	10+
U22187	$15.95	$12.95

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	1-9	10+	100+
BC 547	$0.15	$0.10	$0.07
BC 548	$0.15	$0.10	$0.07
BC 549	$0.15	$0.10	$0.07
BC 557	$0.15	$0.10	$0.07
BC 558	$0.15	$0.10	$0.07
BC 559	$0.15	$0.10	$0.07
BC 327	$0.20	$0.15	$0.12
BC 337	$0.20	$0.15	$0.12
BD 139	$0.70	$0.60	$0.50
BD 140	$0.70	$0.60	$0.50

ELECTRET MIC INSERTS



With Pins for easy board insertion. 10mm diameter, 10mm high.

C10170

1-9	10+	100+	1000+
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Omnidirectional mini mic insert, 6mm diameter. 7mm high.

C10650

1-9	10+	100+	1000+
$2.00	$1.80	$1.30	$1.00

CANNON TYPE CONNECTORS

Cat No.	Product	1-9	10-99
P10960	3 Pin Line Male Plug	$3.95	$2.95
P10962	3 Pin Chassis Male	$3.95	$2.95
P10964	3 Pin Line Female Socket	$3.95	$3.50
P10966	3 Pin Chassis Female	$4.95	$3.95

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• 240V 4 5/8"		
T12464	$14.95	$12.95
• 240V 4"		
T12466	$14.95	$12.95
• 115V 3 1/2"		
T12467	$14.95	$12.95

LOGIC PROBE (LP-2800)



Useful for TTL and CMOS. High & Low indicators pulse memory. For the hobbiest or serious technician for tracing those hard to find faults on logic boards.

Q11272 *Was $19.95*
1-9 **$15.95** 10-99 **$12.95**

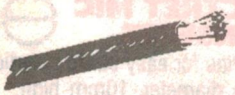
H46 PANEL METER



- 250mA sensitivity
- Centre "0", very useful for balanced circuits and applications requiring a centre "0" or null indication

Q10405 1-9 10+
Was $8.95 **$2.50** **$2.00**

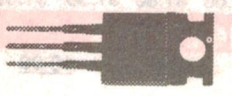
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16 conductor computer interface cable.
- Conductor: 16 x 7/0.16mm tinned copper in colour coded PVC
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- Sheath: P.V.C. O.D. 7.2mm

Cat. No. W12676
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	1-9	10-99
U10900- LM320K-12 (7912UC)		
WAS $1.40	**50¢**	**40¢**
U11090- LM337KC Neg adj. 1.5 amp T0-3		
WAS $12.50	**$6.00**	**$5.00**
U12030- 78l 12 Pos 100MA T092 5V		
WAS 75¢	**30¢**	**28¢**

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TDA2030 AMPLIFIER

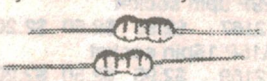
A high quality audio amp in a 5-pin TO220 package that does not require insulating washers between the metal tab and heatsink in single rail supply applications. The amp will operate with single or split supplies. The distortion up to 12W into 4ohm is less than 0.2% typically (less than 5% up to 14W) and up to 8W into 8ohm is less than 0.1% (less than 0.5% up to 9W).



U10186 1-9 **$2.95** 10-99 **$2.50**
Was $4.95

INDUCTORS RF CHOKES

Handy to have a few in your tool box!

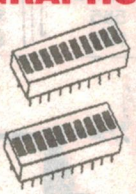


	1-9	10+
L12000 10UH	**40¢**	**30¢**
L12017 82UH	**40¢**	**30¢**
L12023 150UH	**40¢**	**30¢**
L12029 330UH	**40¢**	**30¢**
L12035 560UH	**40¢**	**30¢**
L12038 820UH	**40¢**	**30¢**

IC SPECIALS

CAT No. *NORMALLY*	1-9	10-99
U21990- 81LS95		
$2.75	**50¢**	**40¢**
U10600- LM301N OP AMP		
$1.00	**40¢**	**30¢**
U10700- LM3080 OP AMP		
$2.50	**$1.50**	**$1.00**
U11820- NE567 Tone decoder		
$2.00	**$1.00**	**80¢**
Z14520- 4520		
$1.50	**50¢**	**40¢**
Z17004- 7404		
$1.00	**20¢**	**15¢**
Z17006- 7406		
$1.00	**20¢**	**15¢**
U11570- LM3915 Dot/bar display driver		
$5.90	**$2.00**	**$1.50**

LED BAR GRAPHS

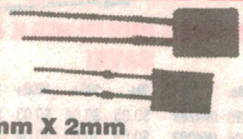


Designed for use in solid state level indicators, each LED is completely separate from the others in the package. They are a 10 segment LED ladder encapsulated in a 20 pin DIL package. .
The displays are available in red or green and may be stacked end to end. Excluding pins. Pin length: 6mm. Pin spacing: 0.3in x 0.1in (standard 20 pin DIL IC spacing)

	1-9	10+
Z10182 *WAS $8.50*	**$4.90**	**$4.50**
(Green bargraph display)		
Z10183 *WAS $8.50*	**$4.90**	**$4.50**
(Red bargraph display)		
Z10184 *WAS $9.95*	**$4.50**	**$4.00**
(Multi colour bargraph display)		

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5mm X 2mm

	1-9	10-99
Z10160 Red	$0.25	$0.20
Z10162 Green		
Z10164 Yellow	$0.30	$0.25
Z10166 Orange	$0.30	$0.25

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T90790 2SK134	**$5.00**	**$4.00**
T90789 2SJ49	**$5.00**	**$4.00**

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Y11009 2.7648MHz	$4.50	$2.00
Y11018 3.9321MHz	$3.00	$1.00
Y11047 7.1590MHz	$3.00	$1.50
Y11060 10MHz	$3.00	$1.10

CANNON TYPE CONNECTORS



	1-9	10-99
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P10961 *Was $3.95*	$2.50	$2.00



3 pin Chassis Female Cannon		
P10966 *Was $8.95*	$4.95	$4.50



3 pin Male-Female Joiner Cannon		
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L11039 *WAS $7.95*	**$1.50**	**$1.25**
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L11300 *WAS $4.95*	**$2.00**	**$1.70**
75OHM TV-FM SPLITTER 4WAY		
L11320 *WAS $9.95*	**$2.00**	**$1.50**

CABLE SUPA SPECIAL

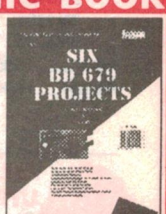
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P19017	DB15 M-F 3M Cable	$34.95	**$9.95**
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P37333	DB25 M-M 3M (Fully wired)	$19.95	**$12.95**
P37335	DB25 M-M 5M Cable (Fully wired)	$24.95	**$17.95**
P37992	DB9 M-M 2M Cable	$14.95	**$7.95**
P37993	DB9 Male-DB9 Male 3M	$19.95	**$12.95**
P37995	DB9 M-M 5M Cable	$24.95	**$19.95**
P39992	DB9 Female-Male 2M Extn. Cable	$14.95	**$9.95**
P39993	DB9 Female-Male 3M Extn. Cable	$19.95	**$12.95**
P39995	DB9 Female-Male 5M Extn Cable	$24.95	**$19.95**
P39292	DB9 M-DB25 F 2M Cable	$19.95	**$9.95**
P39922	DB9F-DB25M 2M Cable	$19.95	**$9.95**
P37342	IBM Printer Cable 2M	$9.95	**$4.95**
P37343	IBM Printer Cable 3M	$19.95	**$12.95**
P37345	IBM Printer Cable 5M	$24.95	**$22.95**
P37349	IBM Printer Cable 10M	$39.95	**$34.95**
P10252	IEC to 3 Pin Mains Cable	$9.95	**$6.95**
P10254	IEC Extension Cord (M-F)	$14.95	**$9.95**
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Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Energy saver

The function of this circuit is to disconnect the power to a computer monitor when the keyboard or mouse are inactive for a predetermined period. The monitor will turn on as soon as either the keyboard or mouse are used.

The heart of the circuit is a 555 timer configured as a monostable. When the voltage to pin 2 of the timer goes low, output pin 3 goes high for the time set by SW1; 20min to 60min. If pin 2 goes low again, transistor Q2 discharges C3 to restart the cycle, without interrupting the state of pin 3. IC1c inverts the trigger pulse to drive Q2.

When pin 3 of IC2 is high, Q1 turns on relay 1, which connects power to the monitor. If pin 2 of IC2 does not go low for the time period set by SW1, the timer will time out, pin 3 will go low turning the relay off and disconnecting power to the monitor.

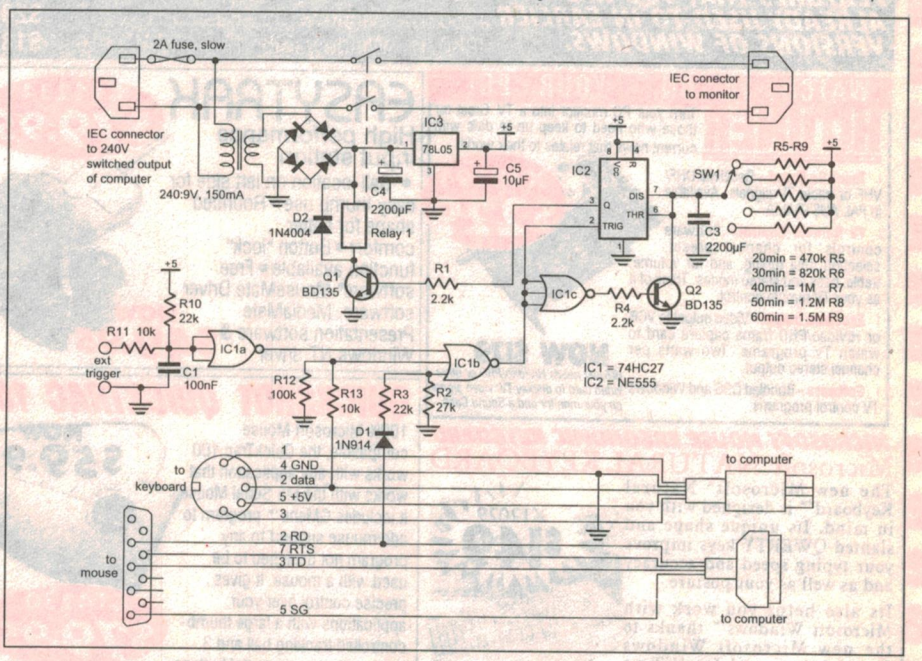
IC1b is a three-input NOR gate that monitors the activity from the keyboard data line and the mouse RD line (serial mouse). Resistors R2, R3 and D1 condition the voltage level from the mouse serial line to the level required by IC1, and R11, R12 and R13 provide protection to the inputs of IC1.

IC1a provides an active low input external trigger that can be connected to say, an infra-red alarm detector in the same room as the computer, so when you go into the room the monitor will come on. The time constant of R10 and capacitor C1 provide IC2 with a trigger pulse when the computer is turned on, to ensure the monitor comes on as well.

Power for the circuit can be derived from the switched 240V output of the computer via a 150mA 9V transformer. After rectification, about +12V is available for the relay (which should have a 5-10A 240V AC contact rating) and to supply IC3, a 5V regulator, which in turns supplies the rest of the circuit. Alternatively the circuit could be powered by a 12V 150mA DC external plugpack.

Take all the usual precautions when working with 240V mains, such as earthing the box containing the circuit if the box is made of metal.

Placid Talia,
Clayton, Vic. **$45**



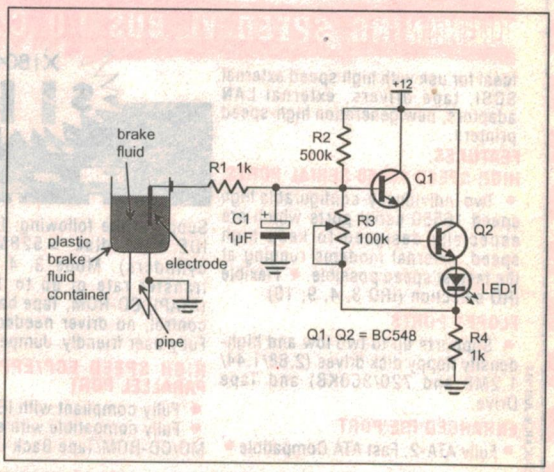
Brake fluid alarm

This circuit was designed mainly to give an indication if the brake fluid in the brake fluid container of a car falls below a certain level, but it could be used with any liquid which presents a resistance similar or less than brake fluid.

The electrode is simply a metal wire of about 40 to 50mm immersed in the brake fluid, giving a resistance to ground of approximately 180k ohms when the container is full. The thicker and longer the wire, the lower this resistance, which will improve the operation of the circuit.

The circuit works like this. If there's brake fluid in the container, current flows to ground via R2 and the brake fluid. This reduces the base current for Q1 to a point where both Q1 and Q2 are off. When the level of the fluid is below the electrode (or near its end) the current through the fluid is negligible and most of the current from R2 will now flow through the base of Q1. Therefore Q1 and Q2 switch on, turning on the LED. The LED current is limited by R4.

Positive feedback is provided by R3 to give a Schmitt trigger action to the circuit, e.g., when the LED starts to turn on, a positive voltage is developed across R4, causing Q1 and Q2 to turn on more quickly. The value of R3 can also be adjusted for different brake fluid levels and sensitivity.



Juan Miguel Akkad,
Pascoe Vale Sth, Vic. **$40**

NiCad charger

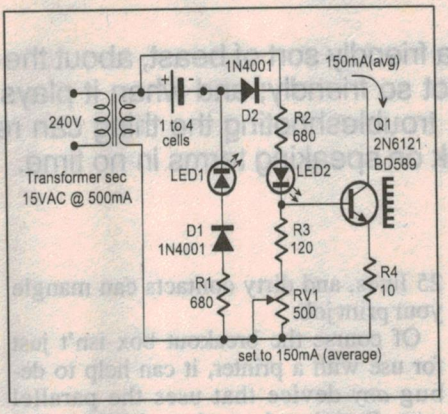
I have three Hewlett Packard calculators (two HP45s and a HP67) that work well, except for the need to rebuild their NiCad cell packs every two years or so, (they cost a small fortune to buy from HP).

Based on Peter Phillips' findings about using a biased AC to rejuvenate NiCads, I reasoned that the battery life of these calculators could be improved with this technique, as the HP charger simply provides a constant DC charge current.

As it happened, I had several NiCad chargers and about 200 AA size NiCad cells that had been donated to the TAFE college where I teach. The charger could charge up to four AA NiCad cells and is basically a half-wave rectifier feeding a current limited series regulator. The current limit was preset at an average current of around 150mA (half-wave rectified sine wave).

To get a bidirectional charge current, I modified the charger by adding a discharge circuit comprising LED1, D1 and R1, with the value of R1 selected to give an average current of around 20mA. This circuit has since successfully rejuvenated quite a number of sets of three AA NiCads (from the donated cells) that previously would not hold their charge for more than a few minutes.

The donated cells were at least six years old and had not been used in that time, so I selected those that showed no signs of leakage To test the cells, I rapid charged each one by applying a current of 2A for no more than about two minutes, while measuring their terminal voltage. Once this rose above 1.6 volts I let them stabilise for 10 minutes. If they measured 1.2 volts or more, I used them to make a number of three-cell battery packs, which were then charged in the modified charger.



An added bonus is that cells don't get warm, even if left in the charger for 12 hours or more. Before the charger was modified, cells would heat up while charging, but even though the ratio of charge to discharge current is only about 7.5 to 1, the individual cell temperature doesn't rise by more than a few degrees above room temperature.

I cycled the battery packs several times by discharging them at a constant rate of around 20mA until flat (less than 1.5V across three series-connected cells) to get rid of any memory effect, and then recharged them for at least six hours. In all cases the batteries performed to their rated capacity.

I have since modified several basic chargers by adding the discharge circuit, and obtained similar results. It appears that this simple addition prolongs the life of NiCads and it certainly rejuvenates cells that I had previously given up on. I have also used the charger to rejuvenate C size NiCad cells, as used in electric screwdrivers.

Two units that would no longer charge from their supplied plugpack are now back in working order after several charge-discharge cycles.

The circuit can be constructed on a piece of matrix board, about the size of a matchbox. The transistor needs a heatsink, also about the size of a matchbox. The original circuit used a 2N6121 NPN transistor (Ic = 4A, Vce = 45V, Hfe = 25-100) and a BD589 is listed as equivalent, although a BD237 will also do the job.

Both LEDs are rated at a maximum forward current of 50mA and all resistors are 1/2 watt 5% film types. I used a 7.5VA miniature PCB mount transformer (15V, 500mA secondary), but any similarly rated transformer will do.

Peter Harle,
Liverpool, NSW. **$45**

Micropower LED flasher

I have used several of these circuits to indicate dark doorways and corners in our house at night. It can also be used as a fake alarm for vehicles where the battery has been removed, or as a light to help find a keyhole at night.

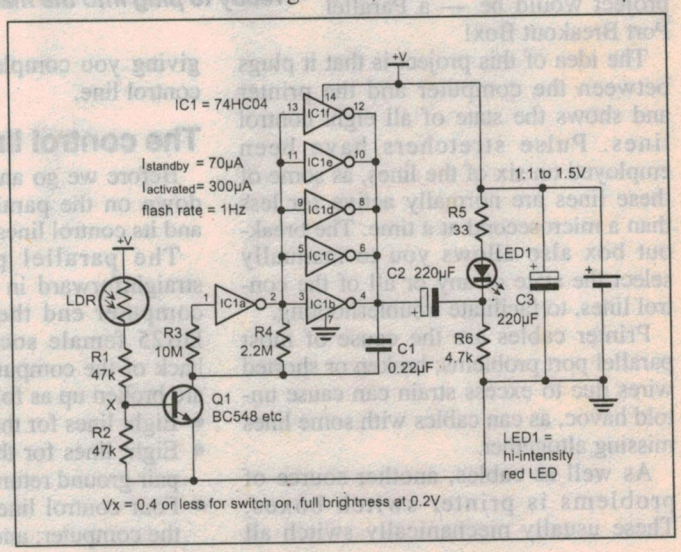
Basically the circuit is a low frequency oscillator with a voltage doubler to overcome the forward voltage drop across the LED. It generates 1Hz flashes with a pulse voltage of 2.3V, derived from a single 1.5V cell. Most brands of 74HC04 hex inverters work reliably in the circuit down to a supply voltage of 1V.

Inverters IC1a and b-f form a low frequency oscillator, with a 50% duty cycle; inverters IC1c to f are para- lleled with IC1b to boost the output current capability. The frequency of 1Hz is set by C1, a 0.22uF non-polar ised capacitor. When the inverter outputs are high, C2 charges to almost the rail voltage through R6. The forward voltage of the LED (1.5V or more) ensures there's no leakage current to charge this capacitor via R5 and the LED.

When the inverter outputs switch low, the voltage at both ends of the capacitor drop by its charge voltage, taking the negative side down to about -1V. As a result, a current surge flows through the LED and R5, giving a bright flash which fades away as C2 discharges.

Capacitor C3 is connected across the battery to reduce the impedance of the supply. This circuit will run on a fresh alkaline AA cell for at least five months, as the oscillator is disabled during daylight. When light falls on the LDR, the base voltage of transistor Q1 increases from near zero (total darkness) to a sufficient level to trigger the transistor into conduction. This connects C1 to ground through the transistor, thus latching the outputs of the inverters high as C1 can't discharge. Current consumption then drops to under 70uA. In darkness the flashes appear bright and almost continuous, making it easy to see from several metres away.

Manfred Schmidt,
Edgewater, WA. **$45**



Construction project:

PARALLEL PORT BREAKOUT BOX

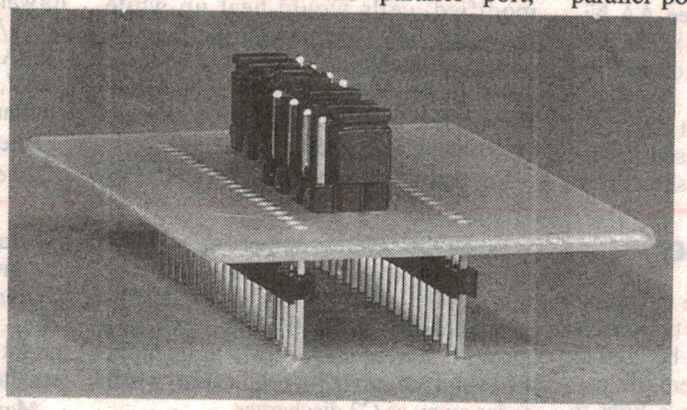
The average PC's parallel port is a friendly sort of beast, about the only port that is actually 'plug and play'. Sometimes, however, it's not so friendly; and when it plays up, it can create problems. With eight control lines to worry about, troubleshooting the thing can really get you down. This breakout box will get you and your port back on speaking terms in no time.

by GRAHAM CATTLEY

While many serial (RS-232C) breakout boxes have been presented over the years, no one seems to have come up with a parallel version. The need for a parallel breakout box was brought to light recently, here in the offices at *Electronics Australia*.

One of our dot-matrix printers refused to communicate with a particular hardware/software combination. The fault was not in the software, as the same program worked perfectly on a different computer. The hardware was okay too, as it would print out using different software. So what was wrong?

It took hours of trying different DIP switch settings and printer drivers, before we discovered that the PAPER OUT line had come adrift in the back of one of the many daisy-chained printer plugs. It was then decreed that the next project would be — a Parallel Port Breakout Box!



A close-up of the sub-board assembly, completed and ready to plug into the main board.

The idea of this project is that it plugs between the computer and the printer and shows the state of all eight control lines. Pulse stretchers have been employed on six of the lines, as some of these lines are normally active for less than a microsecond at a time. The breakout box also allows you to manually select the state of any or all of the control lines, to facilitate troubleshooting.

Printer cables are the cause of most parallel port problems; broken or shorted wires due to excess strain can cause untold havoc, as can cables with some lines missing altogether.

As well as cables, another source of problems is printer switch boxes. These usually mechanically switch all 25 lines, and dirty contacts can mangle your print job.

Of course the breakout box isn't just for use with a printer, it can help to debug *any* device that uses the parallel port. Peripherals such as MIDI interfaces, audio samplers and I/O interface boards can all be connected via the breakout box to the parallel port, giving you complete control over each control line.

The control lines

Before we go any further, a brief rundown on the parallel 'Centronics' port and its control lines might be in order.

The parallel port is reasonably straightforward in its operation. At the computer end the port is (usually) a DB25 female socket mounted on the back of the computer. The 25 lines used are broken up as follows (see Fig.1):

- Eight lines for the eight bit data bus.
- Eight lines for the associated twisted-pair ground returns.
- Four control lines from the printer to the computer; and
- Four control lines from the the computer to the printer.

In order to explain more clearly the function of each control line, let's suppose that the computer is going to print a sequence of characters to a standard printer.

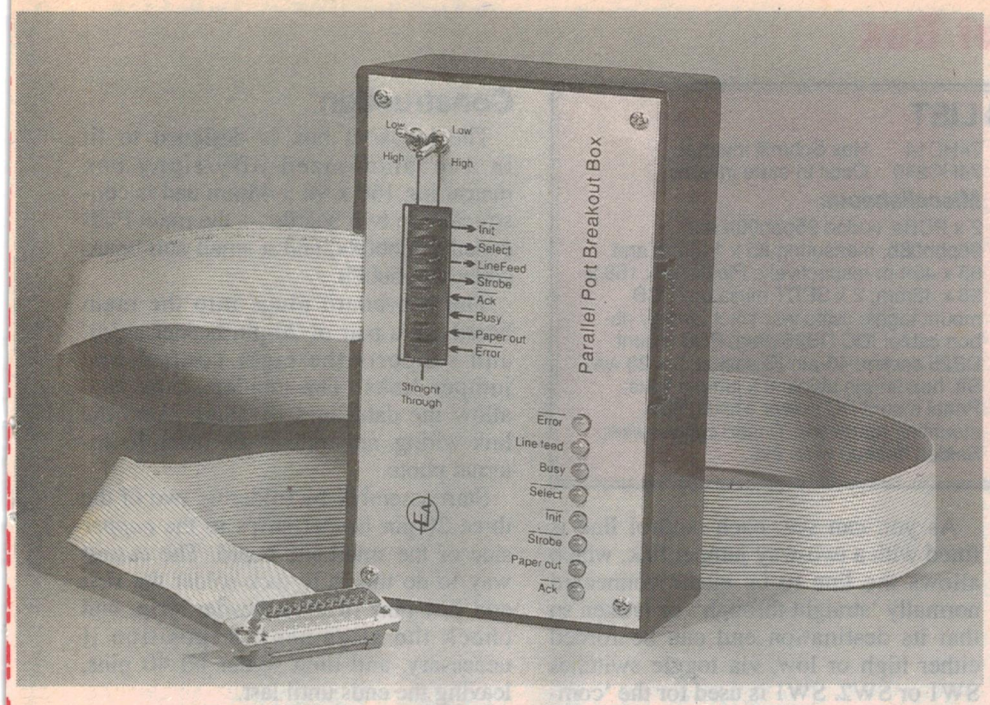
The computer starts off by loading the parallel port's output latch with the binary value of the first character to be printed. This binary word appears on the eight data lines (pins 2 to 9 on the DB25 socket).

About 0.5us later, the computer pulls the STROBE line (pin 1) low, for a period exceeding 0.5us (typically 1us). This negative-going pulse is used to tell the printer that a byte of data is ready to be read from the computer. The printer, on receiving the STROBE pulse, reads the data from the data lines and starts to process the information.

While it is doing this, it sends the BUSY line (pin 11) high to tell the computer that it cannot receive any more data until it has finished with the last byte sent. When the printer is ready, it brings the BUSY line back low again, and also pulls the ACK line (pin 10) low for around about 2 - 8us, telling the computer that it's ready to receive another byte.

Once the computer sees that the printer has acknowledged the current byte, it loads the next byte into its output latch and the whole process repeats.

From the above description, you may notice that the ACK and BUSY lines perform much the same function — tell-



ing the computer when to send the next byte. Indeed, in some systems, the ACK line is hard-wired low, and the printer controls the flow of data by toggling the BUSY line. This means of controlling data flow was used in some older printers, as it worked quite well and used fewer control lines.

Most printers these days have some sort of *printer buffer* which is an area of memory within the printer used to store the data coming from the computer. This data is passed on to the rest of the printer as it is needed. With these printers, both the BUSY and the ACK lines are used to coordinate the data flowing from the computer and through the printer buffer.

In this case, the computer can dump some, if not all, of the text straight into the buffer at high speed, and leave the printer to get on printing it at a more leisurely pace.

The ACK line is used here as normal, acknowledging the byte sent, while the BUSY line is used to indicate that the buffer is full. It goes high only when the buffer cannot accept any more data, and will return low as soon as the printer has chomped its way through some of the backlog.

(Of course if the file being printed is smaller than the buffer, the BUSY line may never go high at all.)

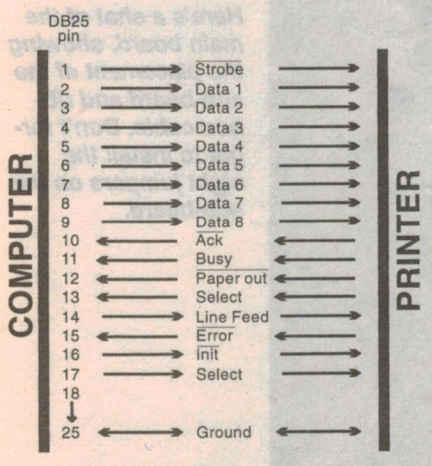


Fig.1: This diagram shows the direction of all the data and control lines used in the parallel port.

Other lines

Of the remaining five control lines, perhaps the next most important would be the ERROR line (pin 15). This, as you may have guessed, is used to indicate that the printer has encountered an error. This line will be pulled low if the printer has been taken off line, or encountered a mechanical problem (i.e., the printer has jammed or has run out of paper).

If the printer *does* run out of paper, not only will the ERROR line go low, but the aptly named PAPER OUT line (pin 12) will go high. PAPER OUT serves only one purpose, that is, to tell the computer that the printer has (surprise, surprise) run out of paper. Some programs ignore this seemingly essential line, and many printers have a DIP switch to force the line permanently low.

The INIT line (pin 16) is a printer reset line, used to initialise the printer to its default settings. When this line is pulled low by the computer, the printer will completely reset, clear the printer buffer and restore all settings to default values. The computer will often pull this line low for a couple of seconds on power-up, and/or when it is reset.

The last of the control lines is LINE FEED (pin 14). This is a computer controlled line and it tells the printer whether or not to advance the paper one line after receiving a carriage return.

When this line is low, the printer will perform a line feed every time a CR character (0D hex or 13 decimal) is received. Again, most printers have a DIP switch to set this line high or low.

How it works

Each of the eight parallel port control lines operates in one of three different ways: normally high and pulsing low (STROBE, ACK, and INIT); normally low and pulsing high (BUSY and SELECT); and steady state (PAPER OUT, LINE FEED and ERROR). Each of these types of signal requires different circuits in order to show anything useful on the LEDs of our breakout box.

Take, for example, the STROBE line (high, pulsing low). This requires a pulse stretcher to stretch the short (0.5 - 10us) negative-going pulse to around 10ms, in order for you to be able to see it.

This is done by buffering the signal through a Schmitt input inverting buffer (U1a). As the input signal is normally high, a low will appear on the output of the buffer, and this low is blocked by the reverse biased diode D6. The input of the second inverter, U2d, is held low by R4 and thus produces a high on its output, turning LED6 on.

When the STROBE line pulses low, a short high pulse is produced on the output of U1a. D6 becomes forward biased, and C4 quickly charges to around 4.5V. As the STROBE line returns high, U1a's output swings low again, but the input to the second inverter remains high due to the charge in the capacitor. After 10ms or so, the voltage on the capacitor falls below the threshold voltage for U2d and

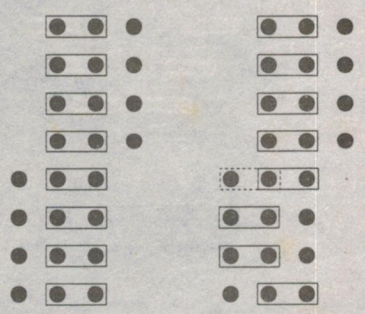


Fig.2: This is the jumper configuration to set the breakout box to 'straight through', while on the right, Fig.3 shows how to set it up as a 'Null printer'.

Parallel Port Breakout Box

PARTS LIST

Resistors
(All 1/4W 5%)

R1-6	1M
R7-14	1k

Capacitors

C1-8	10nF MKT polyester
C9-10	100uF 25VW electrolytic

Semiconductors

D1-8	1N4148 or 1N914 small signal diode
BR1	W04 bridge rectifier
LED1-8	5mm orange or red LEDs
REG1	7805 5V voltage regulator
74HC14	Hex Schmitt inverter
74HC240	Octal tri-state inverter

Miscellaneous

2 x PCBs, coded 95pbb08a and 95pbb08b, measuring 85 x 145mm and 65 x 42mm respectively; Plastic box 158 x 96 x 48mm; 2 x SPDT miniature PCB mount toggle switches; 1m x 26-way ribbon cable; IDC DB25 plug; PCB mount DB25 socket; 40-pin IC socket; 3 x 28 way SIL header pin strips; 8 x jumper links; Panel mount DC power socket; 6BA mounting hardware; Tinned copper wire; Solder, hookup wire, etc...

its output returns high. The nett result is that we effectively turn the LED off for around 10ms every time a STROBE pulse comes along.

The BUSY and SELECT lines are normally low, and pulse high. These are stretched in much the same manner, except that the stretching circuitry is essentially 'upside down', with the diode reversed and capacitor/resistor going to +5V.

The PAPER OUT and ERROR signals, being more or less steady-state, do not need to be stretched and thus go straight to U2f and U2g respectively. The outputs of these buffers will be inverted and thus the associated LEDs are taken to +5V instead of ground.

As you can see, each control line is fitted with a two-way jumper link, which allows the line to be either connected normally 'straight through', or broken so that its destination end can be forced either high or low, via toggle switches SW1 or SW2. SW1 is used for the 'computer to peripheral' lines, and SW2 for the 'printer to computer' lines.

The project has been designed to be powered by 9 - 12V AC or DC, and this is regulated on board using a standard bridge rectifier and regulator combination, to produce +5V to run the circuit. C7 and C8 prevent the regulator from breaking into high frequency ocsillation, while C9 and C10 act as reservoir capacitors.

Construction

The breakout box is designed to fit in a medium sized jiffy/zippy box measuring 160 x 96 x 48mm and is constructed on two boards — the main PCB coded 95pbb08a, and a small sub-board coded 95pbb08b.

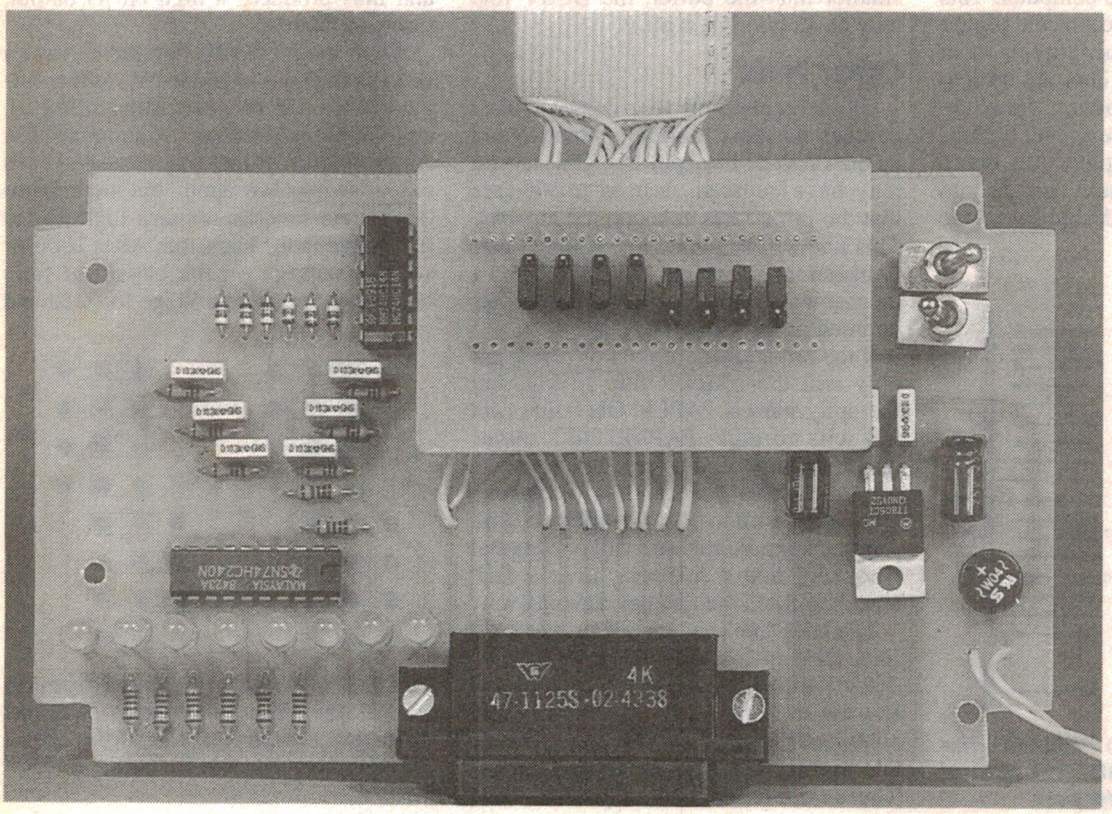
The sub-board plugs into the main board via a pair of 20-pin header strips, and supports the eight control line jumper links. The header strips also allow the data lines to 'jump over' the link wiring, as you can see from the internal photo.

Start assembly by soldering two of the three 20-pin header strips to the *copper* side of the small sub-board. The easiest way to do this is to tack-solder the first and last pins of each header strip, and check the alignment. Reposition if necessary, and then solder all 40 pins, leaving the ends until last.

Next, break the third header strip into eight three-pin strips, seat them on the 'component' side of the board, and carefully solder them into place.

Note that four are positioned with an offset to one side of the centre line between the 20-pin headers, and with the other four offset the other way. A quick look at the photographs should help clarify matters.

That's it for the sub-board, but before



Here's a shot of the main board, showing the placement of the sub-board and ribbon cable. Don't forget to install the eight jumpers on the sub-board.

you mount any components on the main PCB, place the main board copper side up onto the back of the box lid, and mark off the four mounting holes.

Now you can start installing components by soldering into place the resistors, followed by the capacitors and the diodes. Ensure correct polarity for C9 and C10, and of course D1 to D6.

The two SPDT toggle switches are soldered in next, followed by the bridge rectifier and the 7805 voltage regulator. Bend the regulator's leads back by 90° about 3mm from its base and solder it flush with the board — a heatsink isn't necessary as the circuit only draws a few milliamps.

Install U1 and U2 (observing the usual anti-static precautions), and a 40-pin IC socket to accommodate the sub-board. Next, mount the eight LEDs. These are soldered in 12mm above the board, with all the cathodes facing towards the right.

As an aid to keeping all the LEDs at the same height whilst soldering, cut a strip of thin card 12 x 60mm and stand it on edge in line with the LED holes. Place the LEDs so that they straddle the card, and you can now solder the leads in place, and slide the card out afterwards.

The last thing to go on the board is the 25-way, right angle, PC mounting female DB25 socket (Phew!). There are two styles of these around, one slightly longer than the other, so the board has been designed for drilling to accommodate either variety. Before soldering it into place, bolt the socket firmly to the board to prevent strain on the solder connections.

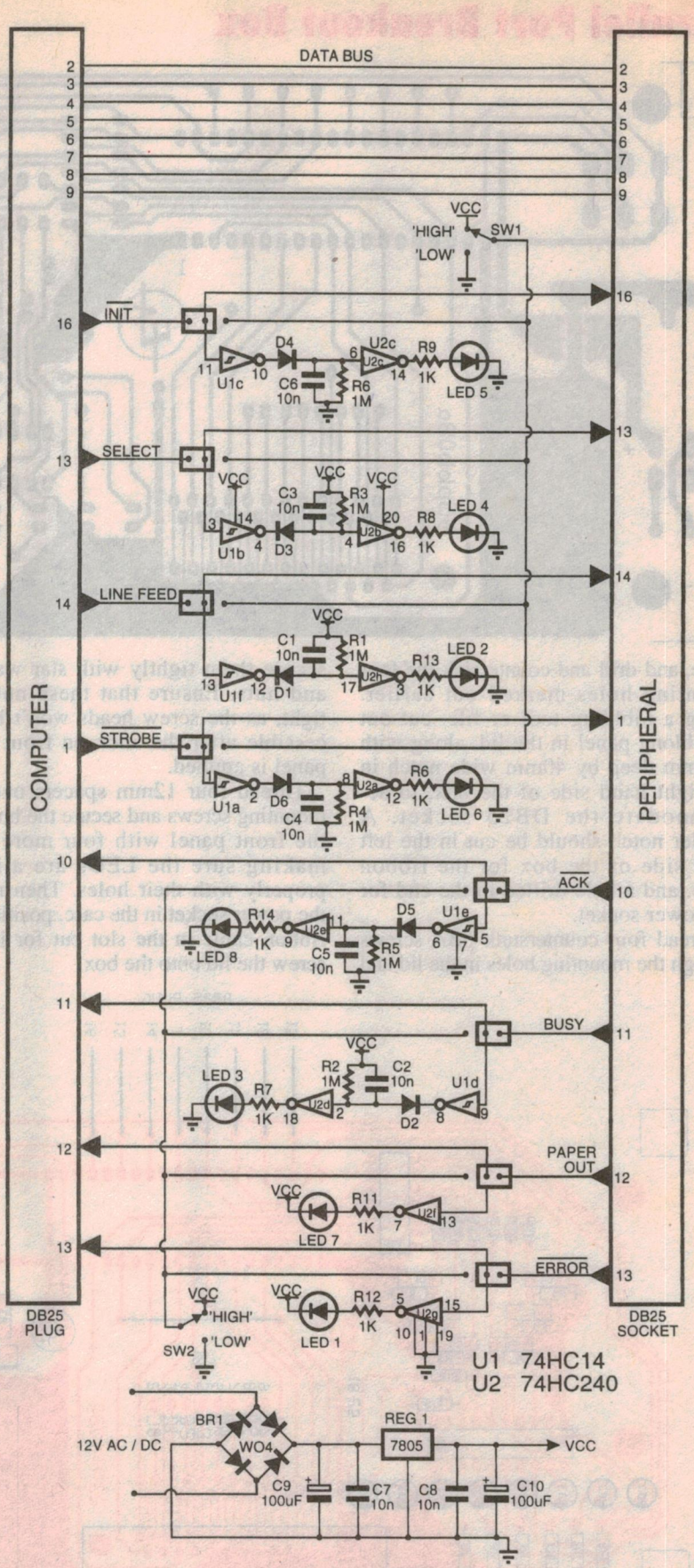
Using a vyce (or the correct crimping tool, if you're lucky enough to have one), clamp the IDC DB25 plug to one end of the ribbon cable. Then separate, strip and tin each of the 25 lines at the other end, and solder them to the board as shown in the parts overlay diagram.

Note that there is no real need to connect all of the eight ground lines. We used only pins 18 and 25 in the prototype, with no problems.

Once you have soldered all of the wires to the board, get your multimeter out and double check that each line goes to the right place — any mix-up at this stage could prove difficult to find afterwards.

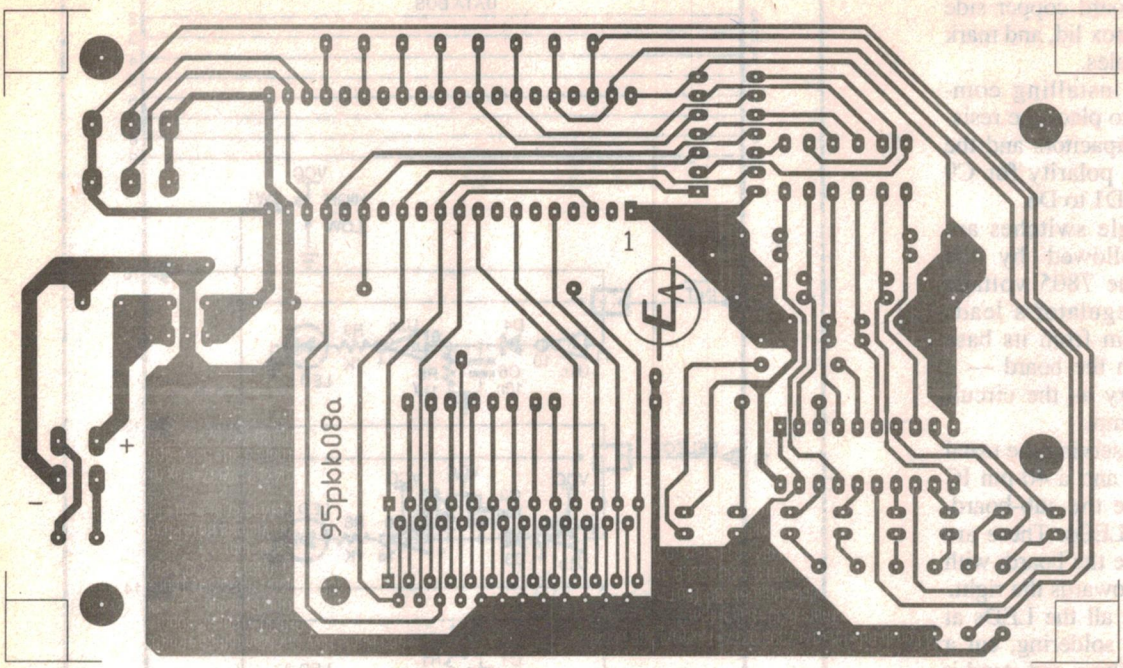
Now wire up the power socket, taking absolutely no notice of the polarity, as it it feeds in through a full-wave bridge rectifier. Carefully plug in the smaller sub-board, ensuring that it's the right way round — pin 1 is marked on both boards to make life easier.

Mark off and drill the lid of the box using a photocopy of the front panel as a



As you can see from the schematic, the breakout box uses relatively few components. It monitors all eight of the 'handshaking' lines, and also allows you to manipulate any selected line if you wish.

Parallel Port Breakout Box



Here's the actual size PCB artwork reproduced for those who wish to etch their own boards.

guide, and drill and countersink the four mounting holes marked out earlier. Using a nibbling tool or file, cut out the oblong panel in the lid, along with a 13mm deep by 40mm wide notch in the right hand side of the box, to accommodate the DB25 socket. A smaller notch should be cut in the left hand side of the box for the ribbon cable, and a hole drilled in the end for the power socket.

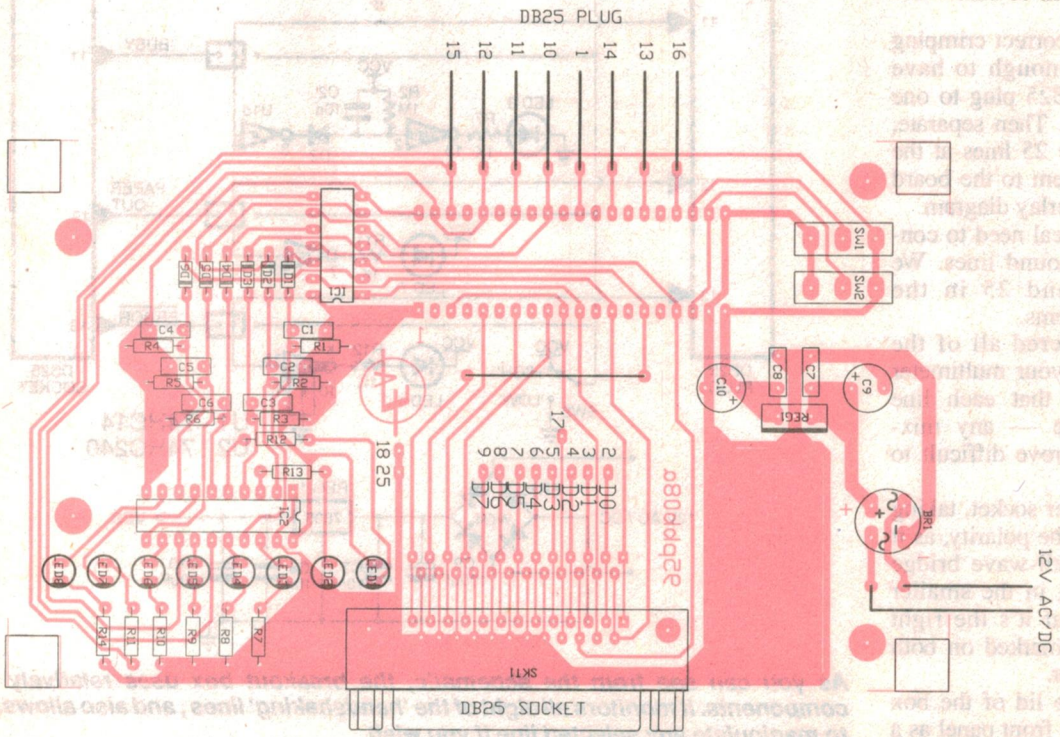
Thread four countersunk 6BA screws through the mounting holes in the lid and secure them tightly with star washers and nuts. Ensure that these nuts are tight, as the screw heads won't be accessible after the stick-on front dress panel is applied.

Thread four 12mm spacers over the mounting screws and secure the board to the front panel with four more nuts, making sure the LEDs are aligned properly with their holes. Then mount the power socket in the case, position the ribbon cable in the slot cut for it, and screw the lid onto the box.

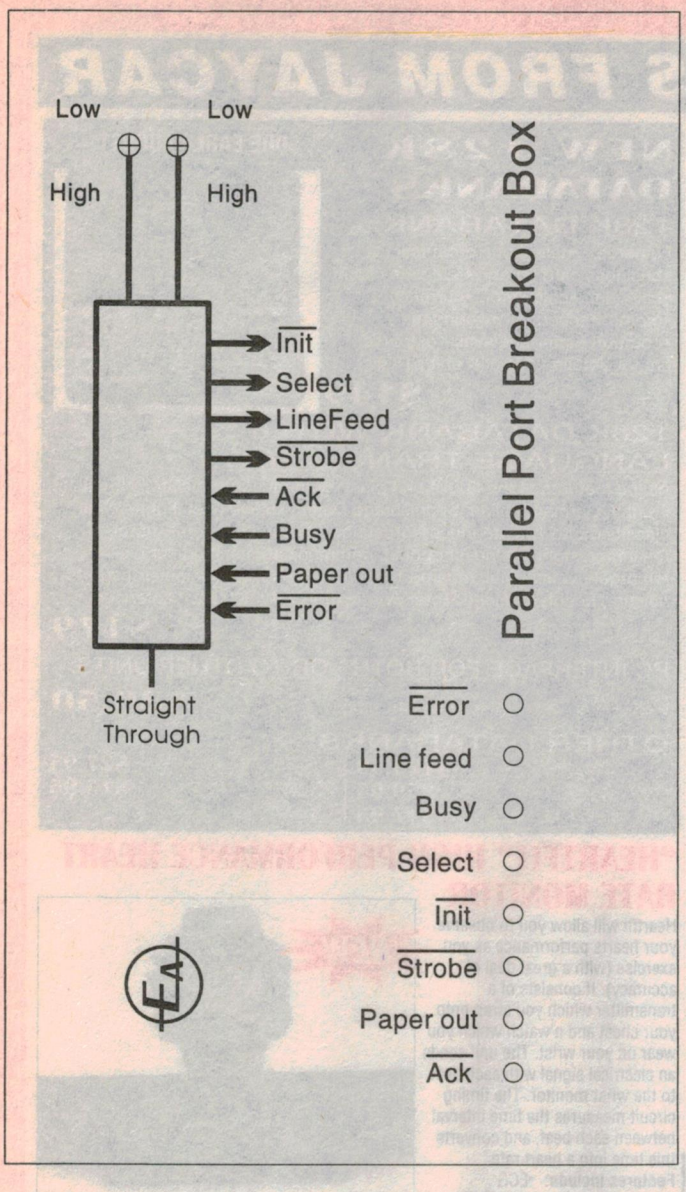
Quick test

Once you have finished construction, the breakout box is easily tested by applying 9 - 12V AC or DC, and plugging it in series with your existing printer cable.

With any luck, The appropriate LEDs should light up, showing the current state of the parallel port. Exactly which LEDs will light depends on your printer. But assuming that the printer is on-line and ready to print, a good indicator that all's well would be the following:



This parts overlay diagram shows how to connect the ribbon cable to the board. The sub-board plugs into the 40 pin IC socket near the top.



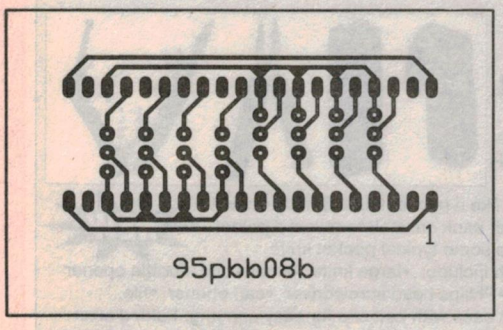
The front panel artwork. Use a copy as a template for drilling the box lid.

ERROR: On
LINE FEED: On
BUSY: Off
SELECT: On
INIT: On
STROBE: On
PAPER OUT: Off
ACK: On

It should be mentioned here that not all printers indicate problems to their computer in the same way.

One small problem comes about because various printer manufacturers seem to have come up with their own system for the printer to tell the computer that it has a problem. Running out of paper is a case in point.

We found that one printer dutifully sent its PAPER OUT and BUSY lines high, and its ERROR line low to let the world know that it had run out of paper, whereas another simply took its ERROR line low, and left you to guess what was wrong. Another problem occurs when the printer goes off line. Some printers will just become BUSY, whilst others will take their SELECT line low as well. It is because of differences such as these that this breakout box was developed.



The artwork for the sub-board, once again actual size. Note that it does not need to have its outer rows of holes drilled, but this may help in aligning the header strips.

Using it

Broadly speaking, the idea behind using a breakout box is to monitor the state of the control lines, to get an idea of what's gone wrong. You can then change the state of any wayward control line, to confirm your diagnosis.

For example, if your printer refuses to print, the first thing to do is to hook the jumpers up as in Fig.2 ('straight through'). The LEDs will then indicate the state of each control line. You can now try to determine which of the control lines were causing the problem, by referring to the list above.

For instance, the PAPER OUT LED might be permanently on. In this case, you could move the PAPER OUT jumper to the left, and switch the left hand toggle switch to the Low position. This would put a low on the computer end of the PAPER OUT line, causing the computer to think that the printer was absolutely stuffed with paper. Assuming this to be the only cause of your printer's hangup, your printer would now act in a healthy, sane and normal manner. This would conclusively prove that it was the PAPER OUT line that was causing the problem.

The breakout box can also be used as a 'Null printer'. Fig.3 shows the correct jumper configuration. This is handy if you have an application that refuses to print, and you're not sure whether it's the hardware or the software that's causing the problems.

By plugging in your Null printer, you can simulate the 'Perfect Printer'. By setting the left hand toggle switch to low, the BUSY, PAPER OUT, and ACK lines will all be held low, tricking the computer into thinking that the printer is always online, ready and waiting for the next character to be printed.

You can now print to the 'printer' at top speed, with no problems. (Confusingly, some computers require a *high* on the ACK line, instead of a low as you would expect. You might have to try the ACK jumper in both positions, to get it to work.)

As this project is a diagnostic tool, it is difficult to give explicit instructions on what to do in every situation, but a little common sense, combined with the occasional midnight sacrifice should clear up most difficulties. ❖

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AUGUST SPECIALS FROM JAYCAR

Universal Fast NiCad Battery Charger With Discharger



This has got to be the "It does everything charger". It will automatically discharge the cell, then fast charge them, then switch to trickle charge. No more trying to remember to switch off the charger. The auto discharger eliminates the dreaded "memory effect" which plagues Nicads.

Features:

•Recharges 1 to 4 pcs AA, AAA, C and D Nicads in 4 hours •Automatically selects the correct charge and discharge rate for different sizes of batteries •Combined with discharge function - batteries are fully discharged before fast charging resulting in full charging capacity of batteries and no "memory effect" •When all batteries have been discharged, it will automatically switch over to charging them •Charger automatically switches from fast charge to trickle charge to prevent damage from overcharging •LED indicators show if charger is discharging, fast charging or trickle charging •9 volt batteries are not fast charged •240V mains powered •Electricity authority approved.

Cat MB-3500 **$59.95**

8 X AA Fast Charger



If you use a lot of AA Nicads and need them fast charged, then this is the unit. It caters for the new type 700mAh batteries. Fast charges them, then automatically switches over to trickle charge. Features Include:

•Recharges 2, 4, 6 and 8 pcs of AA or AAA at a time •Selector switch to alter charging time for 500mAh, 600mAh & 700mAh batteries •LEDs indicate proper charging •Auto current adjustments for AA or AAA batteries •Advanced charging circuit with protection when a charging group is placed with different batteries (AA or AAA) •Charging times - AA 500mAh - 120 mins, AA 600mAh & AAA 180mAh - 144 mins, AA 700mAh & AAA 220mAh - 168 mins •Fast charge for specified period then automatically switches to trickle charge •Electricity authority approved.

Cat MB-3510 **$39.95**

LAB POWER SUPPLIES



Jaycar are proud to announce the release of 3 brand new Laboratory Power Supplies. They are priced well below what you would normally expect to pay. These units are extremely well made and all come in a steel enclosure with output voltage and current meters.

0-30VDC 2.5A VARIABLE

This Lab Power Supply features: •variable output voltage 0-30V •variable current limiting 0-2.5 amp •fixed 5V and 12V output at 500mA •separate voltage and current meters. Also includes current limiting overload LED indicator, on/off switch with power LED indicator, large screw Banana output terminals as well as fixed output push terminals, SAA approved power cord, safety fuseholder. Size 220(D)x125(H)x150(W)mm.

Cat. MP-3080 **only $199.50**



3-15VDC 6.0A VARIABLE

This Lab Power Supply has variable output voltage from 3 to 15VDC, has easy to use low current push terminals as well as the high current banana screw terminals. Also includes overload LED indicator, on/off switch with power LED indicator, SAA approved power cord, safety fuseholder. Size 220(D) x 125(H) x 150(W)mm.

Cat. MP-3085 **only $199.50**

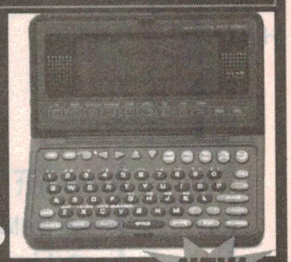
3-15VDC 25 AMP VARIABLE

This unit has identical features to the MP-3085, except for the higher current.

Cat. MP-3088 **only $349.50**

NEW 128K DATABANKS

DUE EARLY AUGUST



128K DATABANK:

Features: •telephone databank •business card library •real time clock •calendar •calculator •currency •memo •schedule •world time •computer interface avail - extra (see cat for details - see 64K unit p183).

Cat. QM-7325 **$149**

128K DATABANK WITH 6 LANGUAGE TRANSLATOR:



All the features of the above unit plus: •6 language translator - English, French, German, Italian, Spanish and Dutch •5,940 useful phrases are classified into 13 categories - greetings, air travel/customs, hotel, resaurant, sight seeing, shopping, communications, medical /emergency, financial, transportation/directions, entertainment, sports /leisure, beauty/hygiene. Total words approx 42,000 (inc sentences).

Cat. QM-7330 **$179**

PC INTERFACE FOR BOTH - OR TO OTHER UNITS:

Cat. QM-7324 (Also suits 64K unit) **$39.50**

OTHER DATABANKS:

64K	Cat. QM-7320	**$129.50**	8K	Cat. QM-7305	**$27.95**
32K	Cat. QM-7315	**$59.95**	45 NAME	QM-7300	**$15.95**
15K	Cat. QM-7310	**$47.95**			

"HEARTFIT" HIGH PERFORMANCE HEART RATE MONITOR



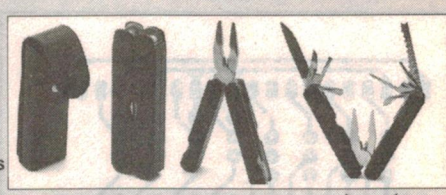
Heartfit will allow you to observe your hearts performance as you exercise (with a great deal of accuracy). It consists of a transmitter which you strap onto your chest and a watch which you wear on your wrist. The unit sends an electrical signal with each beat to the wrist monitor. The timing circuit measures the time interval between each beat, and converts this time into a heart rate.

Features include: •ECG (electrocardiogram) heart rate sensing, accurate readings to 99.9% of clinical machines •programmable high and low limits with immediate target zone feedback •audible target zone alarm, warning of under or over exertion •sports watch, fully waterproof to 50 metres •stopwatch with lap measurement •fitness classifier with recovery step test evaluation •easy to follow instructions •long life battery •comprehensive 1 year warranty.

Benefits are: •improve your cardiovascular function and fitness at any age or level of personal conditioning •effectively and efficiently reach your hearts target heart rate and warn you of under or over exertion •compare the effectiveness of different exercise activities •attain rapid aerobic expansion. Kit includes: comprehensive owners manual, wrist monitor/watch, chest strap and transmitter unit.

Cat. QM-7240 **$99.95**

This Is Not A Leatherman!!!



But is nearly as good and costs only a fraction of the price!!!

Don't know what a Leatherman is? This pocket multitool when folded looks like a pocket knife. Simply open it up, and fold the unit back on itself to reveal a pair of pliers. There is also some typical pocket knife attachments, which include: •large knife •small knife •bottle opener •slot screwdriver •Philips head screwdriver •can opener •file. Supplied in a black case with belt clip for easy carrying. Folded size: 100(L)x30x20mm. **Cat. TH-1900**

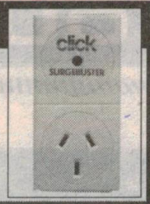


LEATHERMAN SELLS FOR AROUND $110. OUR TOOL IS ONLY $19.95

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SAVE ON MAINS FILTERS



CLICK MAINS SURGEBUSTER SALE

Protect your valuable equipment from damaging power surges. Has 3 MOV's for protection.

Cat. MS-4010 WAS $31.95

NOW $19.95 SAVE $12

TWO OUTLET SQUEEKY CLEAN INLINE MAINS FILTER SALE

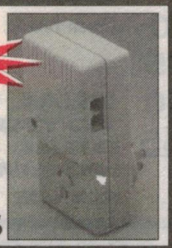


This filter has an IEC mains lead plug and a standard 3 pin box mounted socket. Replace your computer power lead, and plug your monitor in also. For full specs see 1995 catalogue page 118.

Cat. MS-4002 WAS $99.50 NOW $69.50 SAVE $30

MAINS AND TELEPHONE LINE PROTECTOR

NEW



PROTECT FAXES, MODEMS, COMPUTERS, FAX-TAMS
Designed to protect both the telephone line and AC power point from surges as a result of atmospheric disturbances left over from lightening strikes. Gas arrestors protect the telephone line and MOV's the power line.

Cat. MS-4005 **$44.95**

SAVE ON Jaycar RESPONSE DRIVERS

These two drivers were shipped with the standard foam edges instead of the new rubber edges. Our suppliers mistake - your chance to save $$$.

6" 8Ω CARBON FIBRE CONE Cat. CW-2140

Cat Price $79.50 SAVE $20

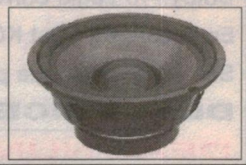
NOW ONLY $59.50



10" 8Ω CARBON FIBRE CONE Cat. CW-2143

Cat Price $169.50 SAVE $40

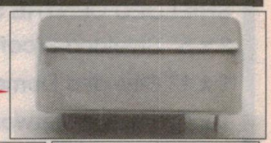
NOW ONLY $129.50

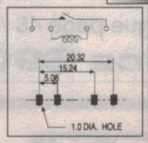


REED RELAY BARGAIN

NEW

We have made a scoop purchase of a SPST 12V magnetic shielded reed relay. Features include: •2.54mm IC terminal arrangement •high switching speed and low bounce time •use gas tube sealed switch to prevent dust etc •wide operating voltage range and low power consumption •used on cordless telephones, modem, burglar alarm PIRs etc.





1-9	$2.00 ea
10-49	$1.50 ea
50-99	$1.20 ea
100+	$1.00 ea

Specifications: •nom voltage: 12VDC •coil resistance: 1050Ω •nom input power: 138mW •must operate volt: 8VDC •must release volt: 0.8VDC •max voltage : 22VDC •case size: 22.8(L)x8.7(H)x8.8(W)mm. Cat. SY-4035

BRAND NEW MODEL

DSC 5 ZONE DIGITAL HOME ALARM WITH DIALLER

INCLUDES EXTRA ZONE

DSC have released a brand new 5 zone alarm. Its identical to the LA5350 in our 1995 catalogue (p69) except for the following: •extra dedicated 24 hour zone •extra programmable output.

SPECIAL OFFER: We have a very small amount of the old model 4 sector units left. The same PIR deal applies to those, PLUS we will give you a FREE Jaytech PIR.

Cat. LA-5350

$279.00



AMAZING INTRODUCTORY OFFER

Purchase one of the first 100 alarm panels, and we will sell you up to 2 x DSC Passive Infra Red Detectors for only $39.95 each. These are normally worth $60 each. PIR Cat. LA-5108

Wireless Doorbell

NEW

This doorbell requires no wiring from the push button to the receiver. The push button is white in colour and has a LED to confirm transmission. Size: 63(H) x 39(W) mm. The receiver has a high or low volume switch and gives a pleasant "ding dong" sound.



TRANSMITTER & RECEIVER

Cat. AI-5520 **$24.95**

EXTRA RECEIVER

Cat. AI-5525 **$19.95**

TURN YOUR SURPLUS STOCK INTO CASH!!!

JAYCAR WILL PURCHASE YOUR SURPLUS STOCKS OF COMPONENTS AND EQUIPMENT. WE ARE CONTINUALLY ON THE LOOKOUT FOR SOURCES OF PRIME QUALITY MERCHANDISE. CALL MARK HARRIS OR BRUCE ROUTLEY NOW ON **(02) 743 5222**

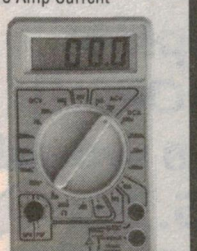
AMAZING VALUE DMM'S FROM JAYCAR

BRILLIANT RANGE OF MULTIMETERS ALL OFFER UNBELEIVABLE VALUE FOR MONEY

For full specifications and list of all the features associated with each model see our 1995 catalogue.

Low Cost

- 3.5 Digit 12.5mm High Display LCD
- Transistor Test
- Diode Test
- •10 Amp Current



QM-1500 $29.95

Pocket

- 3.5 Digit
- Wrap around leads
- Small size
- One hand operation
- Continuity • Diode

NEW



QM-1520 $34.95

30 Range

- Large Display
- Transistor Test
- 20 Amp
- Diode Test



QM-1300 $49.95

Temperature

- Frequency Transistor
- Diode, Continuity
- Capacitance
- Auto Power Off
- Large Display • 20 Amp

NEW

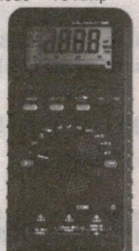


QM-1320 $69.95

Auto Range

- 3.5 Digit
- 1999 Count
- Data Hold
- Bargraph
- Diode • 10 Amp

NEW



QM-1530 $79.95

4.5 Digit

- •Freq Counter •20 Amp
- •Transistor/DiodeTest
- •Capacitance •Data Hold
- •Large Display
- •Auto Power Off
- •19999 Count



QM-1330 $99.95

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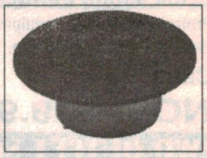
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SURROUND SOUND DEAL

DOLBY SURROUND PRO • LOGIC

If you have been considering building a Dolby Pro Logic Surround Sound Kit, then do it this month and save big bucks. We have a deal for the purchase of the Dolby Kit, and an even bigger deal if you purchase the components for the centre speaker (which you need). You will have to assemble the Dolby kit and make your own cabinet for the centre speaker.







DEAL NUMBER ONE

Dolby Pro Logic Surround Kit KC-5175	$169.50
Enclosure Kit Cat KC-5176	$69.50
See 1995 catalogue page 5	$239.00

DEAL PRICE $219 SAVE $20

Jaycar ELECTRONICS

DEAL NUMBER TWO

SHIELDED CENTRE SPEAKER COMPONENTS

2 x 5" Shielded Woofers Cat CW-2102 $39.95ea	$79.90
1 x 1" Shielded Dome Tweeter Cat CT-2006	$16.95
1 x Crossover Network Cat CX-2613	$8.50
See 1995 catalogue page 46 / Box plans available	$105.35

DEAL PRICE $90 SAVE $15.35

DEAL NUMBER THREE

BUY BOTH TOGETHER AND SAVE EVEN MORE

Deal No 1	$219.00
Deal No 2	$90.00
	$309.00

SAVE $$$

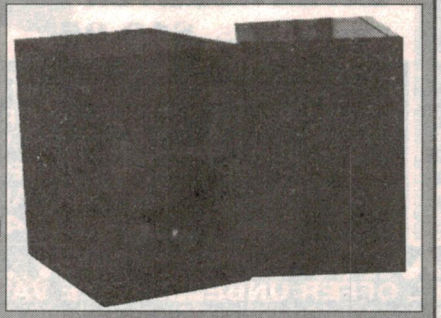
DEAL PRICE $289.00
TOTAL SAVING ON DEAL THREE PURCHASE NORMALLY $344.35 SAVE $55.35

Jaycar Vifa SUPER DEAL

JV20 - SUPER MINI TWO WAY SHIELDED SPEAKER KIT

QUOTE FROM JIM ROWE EDITOR OF ELECTRONICS AUSTRALIA MAGAZINE.

"In short, the JV20 Super Mini Kit Speaker is an excellent little performer, with a quality of reproduction that compares very well with much larger and more expensive systems". Teaming up the JV20s with one of the JV80 kit subwoofers would give you a system that would *really* give many commercial systems a run for their money.



AS REVIEWED IN ELECTRONICS AUSTRALIA JULY 95

Ideal for •Bookshelf speakers •One or a pair as centre speakers for Dolby Pro Logic •Use with JV80 sub woofer •Top quality computer Soundblaster speakers.

SPEAKER KIT: Includes 1 x woofer, 1 x tweeter, 1 x crossover with polyswitches, rear terminal, innerbond & screws.

CABINET: Is fully built and finished in black "blackwood veneer". Grill has cloth mounted.

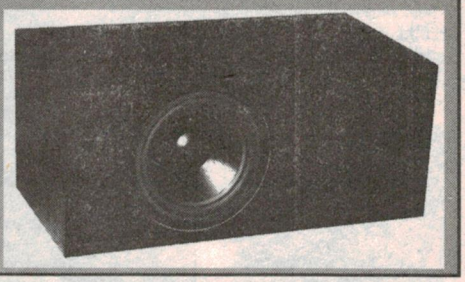
Speaker, Crossover Etc Cat. CS-2580	$169.50ea
Cabinet - Prebuilt Cat. CS-2582	$79.00ea
	Total $248.50ea

Complete set for ONE box only $239 - SAVE $9.50
$478 per pair - SAVE $19 ON A PAIR

JV80 - SUBWOOFER

QUOTE FROM ROB EVANS IN ELECTRONICS AUSTRALIA MAGAZINE.

"The JV80 performed extremely well in both our subjective and objective tests, and really did demonstrate how a refined driver such as the Vifa M22WR can deliver the goods in a correctly tuned enclosure".



AS REVIEWED IN ELECTRONICS AUST. JUNE 95

Power handling is an amazing 150WRMS.

Cabinet size is 35 litres.

Speaker - Vifa M22WR Cat. CW-2115	$199.50
Polyswitch Cat. RN-3472	$10.95
Cabinet Cat. CS-2540	$139.00
	Total $349.45

SUPER DEAL!!!

Buy 1 Pair JV20 and 1 JV80 complete AND SAVE MORE!!! Normally these would cost $827.45. BUY TOGETHER FOR $799

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HOME BURGLAR ALARM DEALS FROM JAYCAR

DEAL 1



Protect Your Home For Under $200

You won't beat this deal anywhere. Checkout what our opposition have available for $249!!! All you need is a bit of labour and you have a reliable affordable alarm that offers you piece of mind.

INCLUDES:	NORMAL PRICE
1 x 4 sector Jaytech panel	$109.50
2 x Jaytech pulse count PIRs	$59.90
1 x mains power supply	$21.50
2 x reed/magnet switches	$11.50
1 x siren horn	$24.95
2 x deterrent stickers	$4.00
50 m of 4 core alarm cable	$28.00
NORMALLY PAY	$259.35

Cat. LA5450 Pay Only $199

DEAL 2



Ideal for larger homes. This system has our 6 sector panel and includes everything that a professional alarm installation company would install and charge around 800-$1000. Save a fortune by doing it yourself.

INCLUDES:	NORMAL PRICE
1 x 6 sector Jaytech panel	$139.50
1 x mains power supply	$21.50
1 x 1.2Ah backup battery	$28.50
3 x Jaytech pulse count PIRs	$89.85
3 x reed/magnet switches	$17.25
1 x strobe	$19.95
1 x metal siren cover	$28.95
1 x siren horn	$24.95
1 x internal siren	$19.95
2 x deterrent stickers	$4.00
100 m of 6 core alarm cable	$88.00
NORMALLY PAY	$482.40

Cat. LA5455 Pay Only $349

DEAL 3



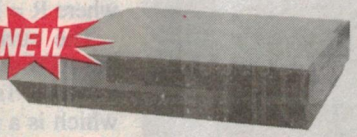
This system inculdes the brand new DSC 5 sector alarm panel with Austel Approved dialler. Connect it to an alarm company or it can phone you or your neighbours etc.

INCLUDES:	NORMAL PRICE
1 x DSC 5 zone alarm/dialler	$279.00
3 x Bellmate 100 PIRs	$119.85
1 x mains 3 wire power supply	$24.95
1 x 6.5Ah backup battery	$43.50
2 x reed/magnet switches	$11.50
1 x strobe	$19.95
1 x metal siren cover	$28.95
1 x siren horn	$24.95
1 x internal siren	$24.95
2 x deterrent stickers	$4.00
100 m of 6 core alarm cable	$88.00
NORMALLY PAY	$669.60

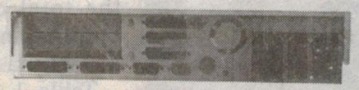
Cat. LA5460 Pay Only $599

BARGAIN COMPUTER CASE

NEW



Another surplus special. Limited quantity. It consists of a metal base/rear panel and fawn coloured plastic top and sides. It measures 360(D) x 340(W) x 70(H)mm.



REAR PANEL SHOWN

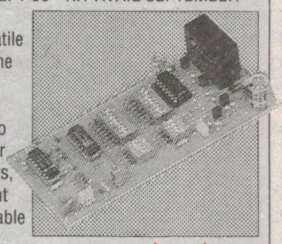
There is a slot in the front panel (26H x 216W) which will accept 2 x 3.5" disk drives or hard disks. Brackets supplied for mounting. The rear panel has numerous cutouts for a myriad of things. These include D25 slot for printer, D25 slot for COM2, D25 slot for SCSI, D37 slot for ext floppy disk, round hole for keyboard, reset pushbutton hole, slots for fan, hole for expansion board 112W x 47Hmm and a hole for a power supply 86W x 53Hmm. Grab one while we have them.Mail order customers add an extra $4 to P&P charges due to heavy weight (3kgs).

Cat. HB-5100 **only $20**

NEW KITS

NEW IMPROVED FLEXITIMER MKII

REF: EA AUG/SEPT 95 - KIT AVAIL SEPTEMBER



This new and extremely versatile flexitimer has the ability to select timing periods from seconds to days. It has four separate outputs, two independant and programmable timing "events", can be sychronised with the 50Hz mains or driven by an internal RC clock, and can be powered from either an AC or DC source. The Jaycar kit includes components to construct all options, printed circuit board and relay.

NEW

Cat. KA-1775 $22.95

PARALLEL PORT BREAKOUT BOX

REF: ELECTRONICS AUSTRALIA AUGUST 95



This project plugs between your computer and printer and shows the state of all eight control lines. It can of course be used to de-bug any device that uses the parallel port such as MIDI interfaces, audio samplers, and I/O interface boards - giving you complete control over each control line. The Jaycar kit is complete with case, PCBs, IDC plug plus all specified components.

NEW

Cat. KA-1776 $45.00

Jaycar ELECTRONICS

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DSE 'Discovery Series' Construction Project:

GENERAL PURPOSE 1.5A REGULATED POWER SUPPLY

The latest release in the new Discovery Series of learning kits from Dick Smith Electronics is this general purpose regulated power supply module, designed to fully exploit the versatility of the LM317T three terminal positive voltage regulator IC. It can be configured in a variety of ways, to provide any DC output voltage between 1.2V and 37.5V at up to 1.5A. The kit for the module is available from DSE's stores as Cat. No. K-2808, priced at $16.95.

Regulators like this one are required for supplying equipment or devices that can be adversely effected by variations in their supply voltage, or where there is a possibility of variations or transients ('spikes') on the 240V mains causing the absolute maximum limits of the equipment to be exceeded.

The high stability of this circuit also makes it useful as a voltage or current reference for testing purposes. Because of its low cost, it can simply be used as a substitute for batteries where the 240V mains or a car cigarette lighter supply is available.

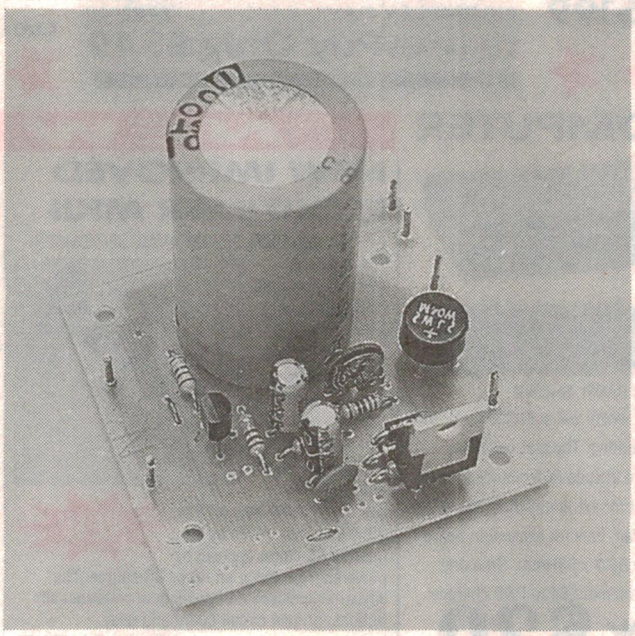
The project can be configured as any one of the following types of power supplies, by inserting or deleting certain components as described in the kit instructions:

- A fixed or variable voltage regulator
- A voltage regulator with programmable current limiting
- A supply with combined voltage/current limiting (e.g., for lead/acid battery charging)
- A constant current source (e.g., for NiCad battery charging)

The LM317 device has built-in current and power overload protection, which makes it safe against those inevitable short circuits and overloads, even if the programmable current limiting is not used.

The circuit is built on a single 50 x 50mm (2" x 2") printed circuit board and includes rectifiers and filters, so that all that is required is an AC or DC source such as a power transformer or plugpack.

Depending on specific requirements as explained in the instructions, a heatsink may be required (this may just involve mounting the board against the side of a metal box).



Operation

For the following description of the circuit's operation refer to the main schematic diagram and the application circuits. For the initial part of the description, we will assume that links J2 and J3 have been inserted to disable the current limiting and current source options.

The power supply is based on the LM317T three terminal series voltage regulator (IC1). This is basically a 1.25V regulator, which is programmed by two external resistors to get any output voltage in the range from 1.25V to 37.5V.

The LM317 maintains a very stable 1.25V reference (which will be referred to in the text as Vref) between the OUT and ADJ terminals of the regulator. Vref can actually be anywhere between 1.20V and 1.30V (a 4% range due to manufacturing tolerances), but for any particular device it has a value within this range which varies no more than typically 0.3% with an output current change from 10mA to 1.5A, and by 1% with an internal temperature variation of 0 to 125°C.

The voltage at the circuit's DC OUT terminals is determined by the values of resistors R1, R2 and VR2, and is given by the formula:

$$Vo = Vref * (1 + R/R1) \quad \text{.....(1)—}$$

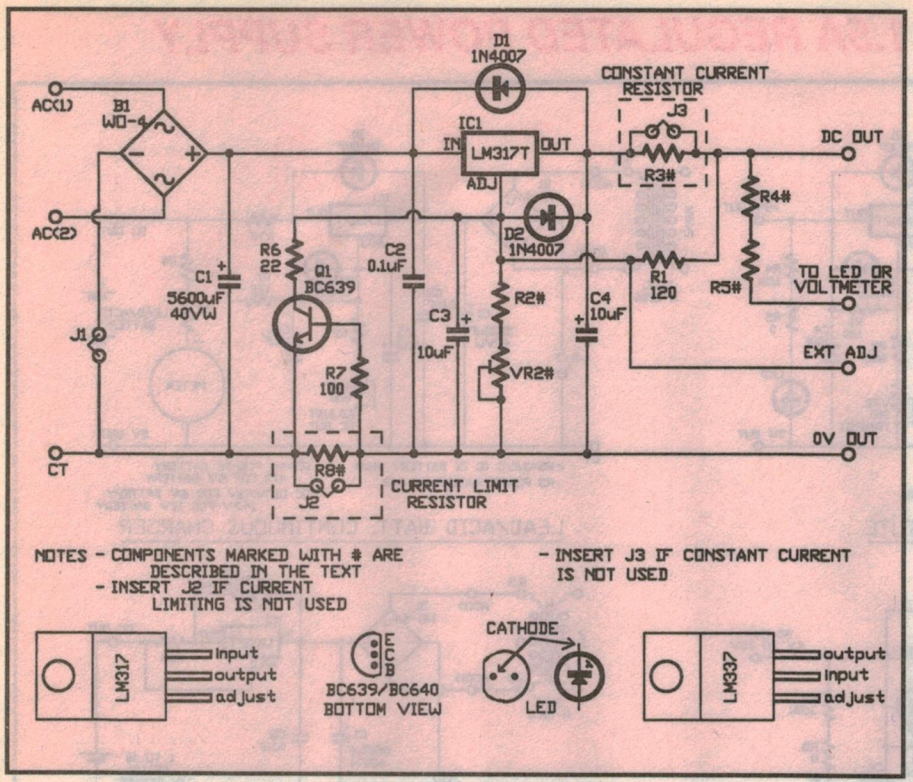
where R = R2 + VR2

The current that flows from the ADJ terminal through R2 to ground is typically 50uA, which is a negligible fraction of the total current through R2 (10mA) and so is not included in formula (1).

Table 1 gives sample values for R2, VR2 and Vo as calculated from formula (1). The minimum output voltage obtainable from the supply is equal to Vref, and is achieved by replacing R2 and VR2 with zero ohm resistors or wire links.

One requirement for proper operation of the LM317 is that the current from its OUT terminal must be at least 10mA. This is achieved by making R1 equal to 120 ohms, so that the current through R1, R2 and VR2 is always 10mA independent of the value of R2 and VR2. This way the voltage regulation is maintained even without an external load.

Although R1, R2 and VR2 determine the ultimate output voltage of the regulator, it is necessary to add some capacitance, as with most regulators, to stabilise the circuit against rapid changes in load or line conditions. The 10uF



Based on a standard LM317 adjustable regulator chip, the regulator module can be adapted by links to suit a number of different applications. With J2 removed, transistor Q1 provides current limiting.

capacitor C3 connected between the adjust terminal and ground is used to reduce the amount of AC ripple that is fed through from the unregulated input to the output, and 10uF capacitor C4 is used to swamp any ringing that may otherwise appear at the output under various load conditions.

Ceramic capacitor C2 (0.1uF) is necessary to bypass high frequencies that appear at the input to the LM317, because large capacitors like C1 are not very effective at high frequencies, and the isolation between C1 and the IN terminal due to the inductance of the connecting track also reduces its effectiveness at high frequencies.

If the input to the regulator is switched off, it is possible for the voltage on the OUT terminal to be higher than the voltage on the IN terminal due to the charge stored in C4, or due to having a battery under charge connected to the output. To prevent this reverse voltage from damaging the LM317, diode D1 is added to bypass this voltage around it.

In a similar way, the LM317 can be damaged by the charge on C3 causing the ADJ and OUT terminals to be reverse biased when the output is shorted to ground. This is prevented by D2, which again bypasses the reverse voltage.

When the circuit is used as a fixed voltage regulator, VR2 can be either a 1/4W metal film resistor or a 5mm vertical mount trimpot (there are suitable pads on the PCB for mounting either). It is better to use a resistor than a trimpot, because trimpots can later change their value due to vibration, dirt or maladjustment.

If the circuit is used as a variable voltage regulator then VR2 can be replaced by two PCB pins, to make connection to an externally mounted potentiometer used as the variable voltage control.

As with most regulators, there is a minimum voltage that must be maintained between the IN and OUT terminals of the LM317 for proper regulation. This value (Vin-Vout) is called the *dropout* voltage. The dropout voltage varies with temperature and load current, but for this device it does not exceed 2.5V under normal operating conditions.

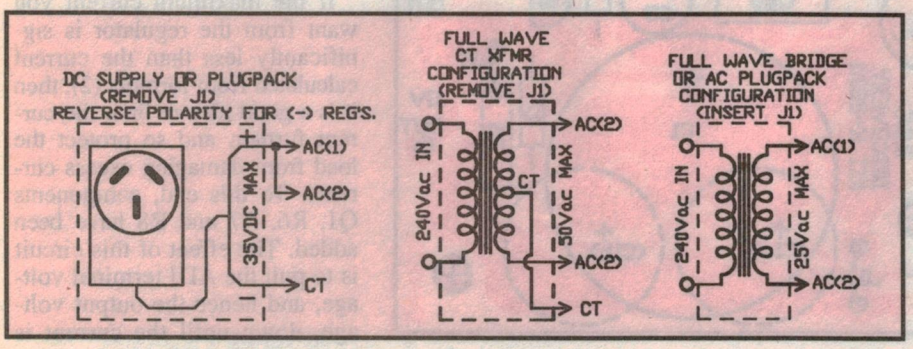
The project has been fitted with a rectifier bridge B1 and a 5600uF filter capacitor C1 so that the supply to the regulator can be either AC or DC. The schematic diagram shows how to connect the various sources to the input. Filter capacitor C1 ensures that the ripple voltage appearing at the input to the LM317, when using 50Hz AC supplies, does not exceed 2Vp-p under any load conditions.

The capacitor supplied in the kit for C1 has a working voltage rating of 40V to match the 40V absolute maximum input voltage of the LM317, but provision has been made on the PCB for using two smaller 2200uF/25VW capacitors in parallel if the voltage is not going to exceed 25V.

If the unregulated source for the regulator is a DC supply, the positive terminal of the source is connected to both AC(1) and AC(2) and the negative terminal to CT. Wire link J1 must be left out, or else the bridge will be damaged if the polarity is reversed. With this connection method, the input current effectively flows through two parallel diodes in B1, which offer reverse polarity protection and result in a voltage at the LM317's IN terminal of less than 1V below the source voltage.

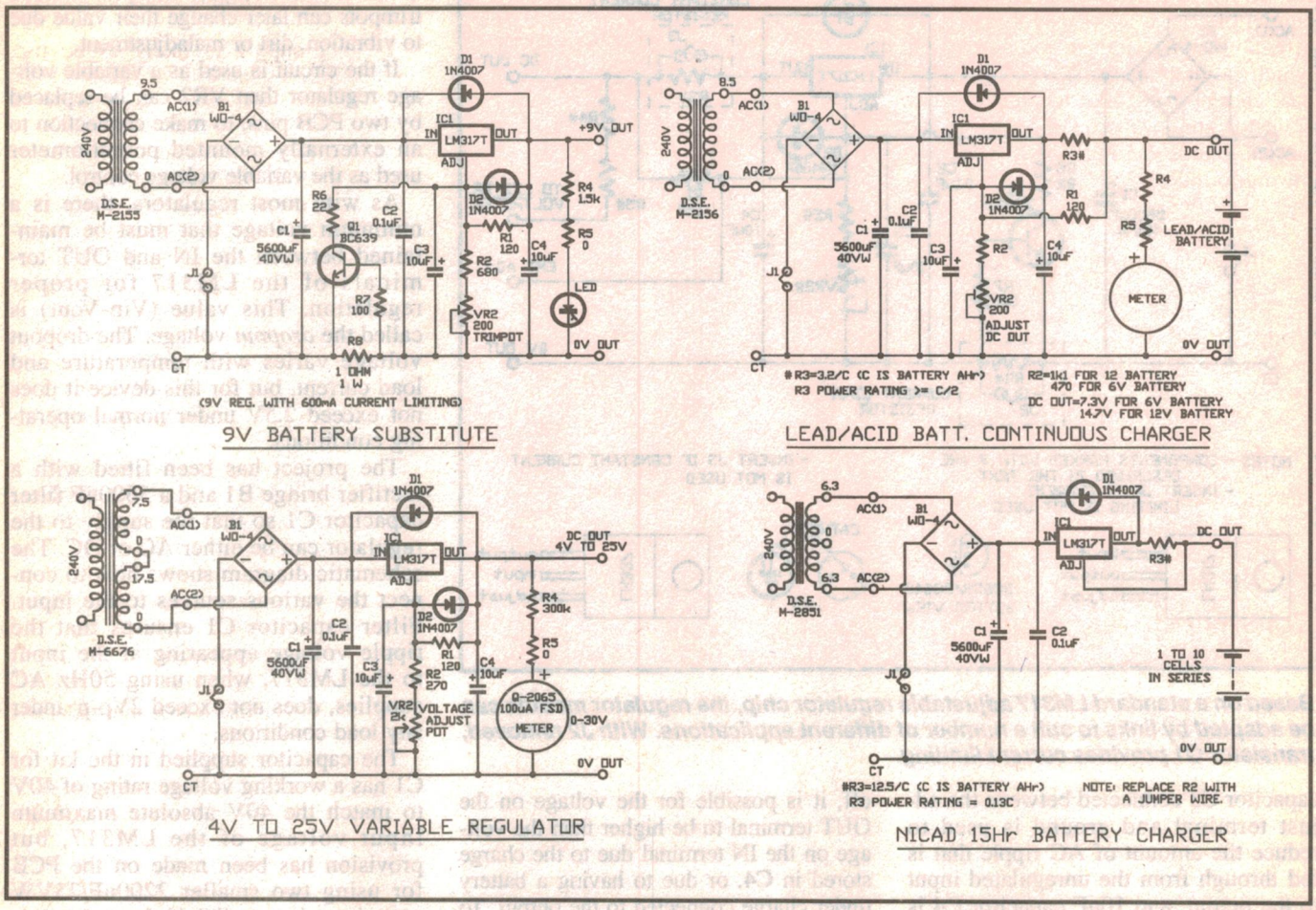
The most common AC source will be a two-wire mains transformer output. This is connected between AC(1) and AC(2), with link J1 inserted. To work out what voltage is going to appear at the IN terminal in this case, let us consider the case of a transformer with a 25V/60VA secondary winding.

Firstly, we have to allow for the possibility of the 240V mains reaching about 254V, which will increase the secondary voltage to 26.5V. Secondly, if the transformer regulation is about 6%, which is a typical value for this size transformer, then without a load con-



Three different configurations can be used to drive the regulator module from either a DC supply or plugpack, a transformer with a centre-tapped secondary or a transformer with a single secondary winding.

GENERAL PURPOSE 1.5A REGULATED POWER SUPPLY



Examples of some of the regulator module's applications. As you can see, it can be used as a 9V battery substitute (top left), a continuous charger for lead acid batteries (top right), a 4V to 25V adjustable bench supply (lower left), or a 15-hour constant current charger for NiCad batteries.

nected to the regulator output, the transformer secondary voltage will be about 28.0V. The instantaneous peak value of this voltage is 39.7V and so the value of Vin will be 39.7V — minus two diode voltage drops through bridge B1, which makes Vin about 38.5V.

The overvoltage conditions just mentioned are the reason why the recommended maximum transformer secondary voltage applied to this circuit is 25V.

Current limiting

The current limiting built into the LM317 is designed to limit its power dissipation to 25W. This is the maximum power that the LM317 can dissipate when the room (ambient) temperature is 25°C, even if it is attached to an infinite heatsink, before its internal (junction) temperature exceeds 125°C. So without the optional external current limiting, the maximum available current from this regulator can be calculated from the following formula:

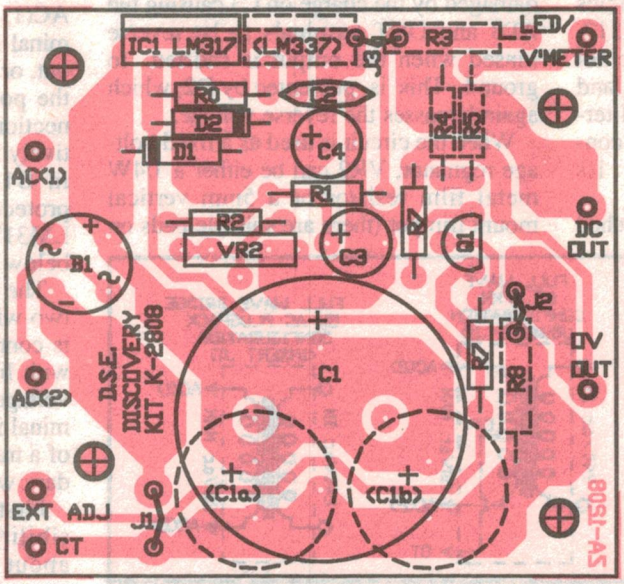
Imax = 25/(Vin - Vout).....(2)

or Imax = 1.5A

(whichever is smaller)

If the maximum current you want from the regulator is significantly less than the current calculated from formula (2), then it is a good idea to limit the current further, and so protect the load from damaging excess currents. To this end, components Q1, R6, R7 and R8 have been added. The effect of this circuit is to pull the ADJ terminal voltage, and hence the output voltage, down until the current is no more than the limit value determined by the value of sensing resistor R8.

The way it works is that the



Use this overlay diagram as a guide when wiring up the regulator module. The dashed components represent various options, as explained in the text.

load current causes a voltage drop across R8, which is fed between the base and emitter of Q1 via R7. This voltage has no effect until it reaches about 0.6V, at which point transistor Q1 gets enough base current to begin conducting between collector and emitter. The value of this current limit is therefore given by the following formula:

Imax = 0.6/R8..... (3)

There are a couple of restrictions on the effectiveness of this current limiting.

Firstly, the current limit is *not* a sharp cut-off — it starts to limit when the Vbe of Q1 is just below about 0.6V, and increases rapidly above that. Secondly, even when the ADJ terminal voltage has been pulled down to 0V the output voltage is still 1.25V, and if this voltage is not low enough to reduce the current, then the limiting reverts to the LM317's own internal limiting. Resistor R8 must be rated to withstand a 2A constant current.

Constant current source

The LM317 can be configured as a constant current source, as shown in the Nicad charger application circuit.

The value of the output current is determined by the value of resistor R3, according to the following formula:

Iout = Vref/R3..... (4)

The value of this current cannot exceed the LM317 limit as given by formula (2), and when using R3 for current-mode operation the link J2 should be inserted to disable the optional current limit circuit.

This form of current control can be combined with voltage regulation to provide a circuit that is especially suitable for charging lead/acid batteries (refer to the circuit application), with current limiting when the batteries are flat, and voltage limiting when they are fully charged.

Heatsinking

For optimum regulation and maximum output current, the LM317 should be attached to a heatsink. Although it is internally protected to prevent its semiconductor junction temperatures exceeding 125°C, its life can be shortened if this limit is reached too many times. The junction temperature depends on the total power dissipation of the device and on the thermal resistance between the junctions and ambient (the outside world).

For the LM317T the thermal resistance between the semiconductor junctions and the metal tab (θjc) is 4°C per watt — i.e., for every watt of power it dissipates, the temperature difference between the junctions and the case increases by 4°C. Between the junctions and the air (θja), without a heatsink, it is 50°C/W.

Thermal resistance (θ), temperature (T) and power (P) are analogous to electrical resistance, voltage and current respectively, and are related by the following formula:

T = θ * P(5)

Which is analogous to Ohm's law (V = R * I)

Using this formula the junction temperature of the IC can be calculated using heatsinks of known thermal resistance. The heatsink's thermal resistance (θca) is effectively in series with that between the junctions and the tab (θjc), so the total thermal resistance between junctions and ambient (θja) is found by simply adding the two together.

The resulting figure for θja can then be used in formula (5) to work out the maximum power, knowing the maximum junction temperature (125°C). Note, however, that the 'T' found using formula (5) will only be the temperature difference across θja for a given power dissipation — so to find the maximum junction temperature Tj, you'll have to add in the maximum ambient temperature Ta.

If your supply is likely to be used in a building where the temperature can reach 35°C in summer, it might be a good idea to allow say 40°C as the maximum value for Ta.

The thermal resistance of heatsinks sold by DSE are shown in the DSE catalog. These figures assume a good thermal bond between the case or tab of the semiconductor device and the heatsink — using a thin smear of thermal compound.

Having calculated the maximum power dissipation allowable for the LM317, the maximum current it can supply can be found by the following formula:

Imax = Pmax/(Vin - Vout)

Combining this formula with that of formula (5), we get:

$$Imax = \frac{[(Tj - Ta)/(\theta jc + \theta ca)]}{(Vin - Vout)}$$

so for the LM317, we end up with:

$$Imax = \frac{[(125-Ta)/(4 + \theta ca)]}{(Vin - Vout)}...(6)$$

For example, if the air temperature is 25°C, the heatsink has a thermal resistance of 2°C/W and the voltage across the LM317 is 20V, then (allowing say for an additional thermal resistance of 0.8°C/W for the joint between the heatsink and the case of the LM317):

Imax = [(125-25)/(4 + 2 + 0.8)]/20
= 0.74A

External control

If there is a need to remotely set the regulator voltage, then R2 and VR2 can be replaced by a variable resistance connected between the EXT ADJ terminal and the 0V terminal (not the CT terminal).

The voltage could then be controlled, for example, by a computer program using the Discovery Series Computer Interface Kit K-2805, with each of its digital outputs switching a different resistor to the EXT ADJ terminal. Note that the computer and K-2805 earths would have

Continued on page 83

PARTS LIST

Resistors

(0.25W 1% metal film unless otherwise stated)

R0	Zero ohm jumper wire
R1	120 ohms
R2	values from table 1 supplied: 24, 150, 430, 680, 1k, 1.2k, 2k
R3	optional, not supplied in kit
R4,5	optional, not supplied in kit
R6	22 ohms
R7	100 ohms
R8	1 ohm 1W carbon film
VR2	200 ohm 5mm vert trimpot

Capacitors

C1	5600uF 40VW RB electrolytic
C2	0.1uF ceramic
C3,4	10uF 63VW RB electrolytic

Semiconductors

IC1	LM317 adjustable regulator
Q1	BC639 NPN transistor
D1,2	1N4007 silicon rectifier diode
B1	WO-4 bridge rectifier

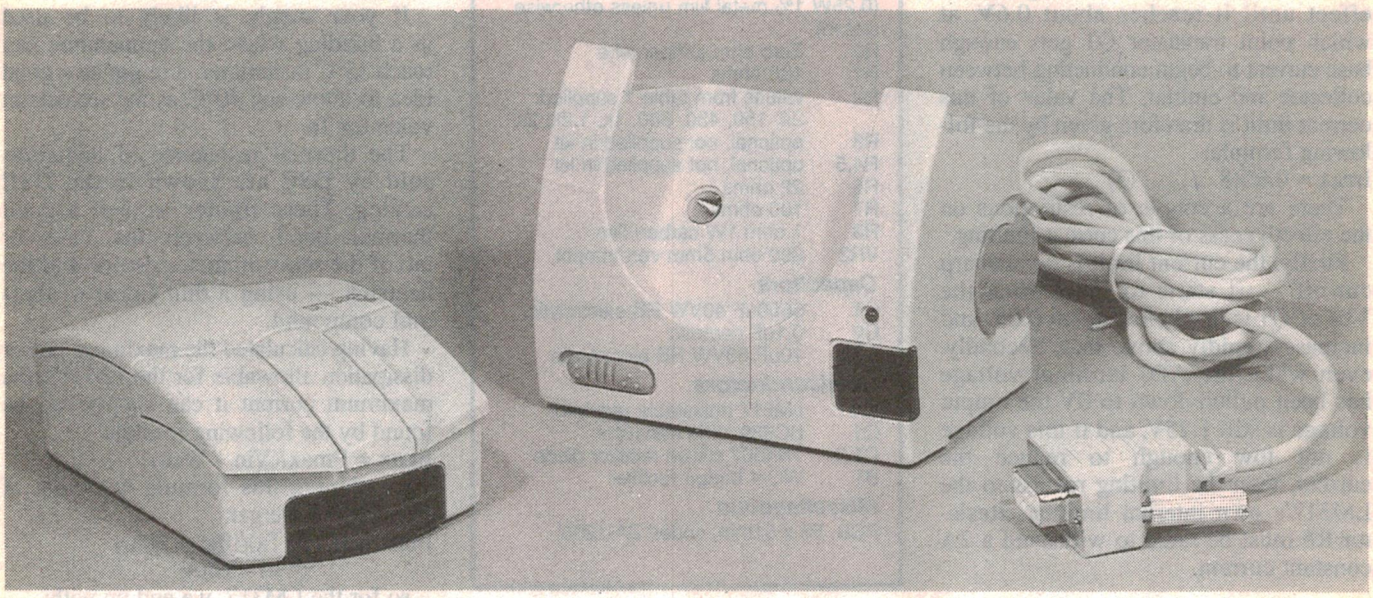
Miscellaneous

PCB, 53 x 51mm, coded ZA-1208.

Specifications

Dimensions	51 x 53 x 41mm (LxWxH)	
Output voltage limits	+1.2V to +37.5V (optionally -1.2V to -37.5V)	
Temperature stability	1% typ for Tj < 125°C	
Load regulation	0.3% typ Iout < Imax (Iout taken from LM317T tab)	
Line regulation	0.02%/V typ for 3V < Vin-Vout < 40V	
Output current	1.5A max with heatsinking	
Input voltage limits	AC supply (two wire)	4-28V AC (recommended 25V max)
	DC supply	5-40V DC
Overload Protection (all configurations)	current limit	1.5A min
	temperature limit	Tj = 125°C max

Computer Product Review:



THE GENIUS CORDLESS MOUSE

Cluttered desk? Keep sweeping papers onto the floor? Or maybe you feel that your creative spirit is a bit tied down by that mouse 'tail'. Well, Genius have come up with the answer; their HiMouse Cordless seems to have been very well designed, and consequently easy to set-up and even easier to use.

by GRAHAM CATTLEY

The mouse has risen over the years to become one of the most commonly used of computer peripherals. It is surprising, then, that at the same time it's one of the least regarded pieces of equipment around. People will spend weeks choosing the best computer system for their needs, but then grab the nearest mouse off the shelf to complete the package.

In most applications, the mouse has taken over from the keyboard as the main source of user input — but how many users pay any attention at all to the humble rodent? Surely such a vital piece of equipment should be considered a major part of the computer, rather than just a peripheral.

The fact that the basic design of the mouse hasn't altered over the last 20 years, would seem to indicate that mouses, as a whole, have reached their evolutionary peak. So what's next? How could anybody improve upon the mouse? Optical mouses have enjoyed a certain elitist popularity, but tend to be rather expensive.

One of the most obvious weak points of the average mouse would have to be the cord, and the people at Genius seem to have tackled this problem admirably with the HiMouse Cordless. The HiMouse package consists of two parts: the mouse itself, which looks more or less like any other mouse (only cordless), and a base unit which plugs into the computer.

The mouse is a little chunkier than most, measuring 105 x 55 x 35mm. Underneath is the usual ball and locking ring assembly, and a small cylindrical battery pack which is trickle charged whenever the mouse is returned to its base unit.

The front of the mouse sports an infrared filter, through which the mouse communicates with the base unit, using two infrared LEDs.

The mouse can act as either a two or three-button mouse, selectable by a switch on the base unit. The micros-witched mouse buttons themselves had a nice feel, and were slightly sculpted to fit the hand. The base unit measures 55 x 90 x 70mm and acts as a combination of infrared receiver, mouse holder, and battery charger.

Mousing around

I found the mouse very easy to set up, with the user's guide being very clear and informative — a pleasant change from the usual manuals provided with a lot of other computer peripherals.

The base unit connects to the computer via a 1.5m cord terminated in a standard DB9 socket (you will need to

buy a 9-to-25 pin adapter if you don't have a 9-pin serial port) or, if you bought the PS/2 version, a PS/2 plug. This cord not only allows the unit to communicate with the computer, but supplies the power required to run the base unit and to recharge the batteries in the mouse.

This system of 'stealing' power from the serial port seems to work quite well, as the unit charges not only the mouse battery, but also two spare battery packs which are clipped into the side of the unit. The mouse needs to be fully charged before it can be used, and this requires leaving the computer on and the mouse in its 'mouse house' for a period of some hours after initial installation. (The user's guide recommends 'a day', to fully charge the batteries.)

This initial delay may pose a bit of a problem with the more eager users, as there is no way to use the computer with any software that needs a mouse, while the mouse is charging. However, after a (lunch) hour, the mouse had charged enough to enable me to use it for the rest of the day.

In fact, I found that over the two months that I had used the mouse, I didn't have to worry about any aspect of charging — just remembering to replace the mouse in its holder at the end of each session was enough to keep it 'topped-up', even when the computer was turned off.

Off? Yes, due to an ingenious change-over system, the two spare batteries will trickle charge the mouse whenever the computer is off. But when it's on, the computer charges all three of the battery packs simultaneously.

Power saving features

The HiMouse Cordless includes a couple of nice power-saving features, including 'going to sleep' if it isn't used for a couple of minutes, and the addition of a 'Near/Far' switch accessible from within the battery compartment on the mouse. This switch determines the output power of the IR LEDs, and the Near setting was more than adequate, giving a range of over two metres, even with the base unit rotated 180°! (Obviously the IR light was being reflected off the side of the computer.)

The supplied mouse driver software for DOS and Windows was just as easy to set up, and by following the clear instructions in the user's guide, I was able to get the whole system up and running in a few minutes. (One minor hassle was that the user's guide didn't tell you that you needed to remove any existing mouse driver from your autoexec.bat file before installation. But this was easily fixed and the driver installed without any problems.)

Bundled with the mouse is a copy of the Windows application *PC Paintbrush*, a rather comprehensive painting program, and *MediaMate*, a multimedia presentation package. Once the Windows mouse driver was installed, they proved to be excellent applications to show off the agility and usefulness of the mouse.

As a mouse, the HiMouse Cordless performs admirably. I found no sign of 'lagging', with the screen pointer responding instantly to any movement of the mouse, and, due to its power saving features, the mouse is still running on the battery pack installed over two months ago.

All in all, I found the HiMouse Cordless a well designed, easy to use, and practical component suitable for almost any computer system.

The Genius HiMouse Cordless is available from Rod Irving Electronics stores for $99.00 RRP. ❖

GENERAL PURPOSE 1.5A REGULATED POWER SUPPLY

Continued from page 81

to be connected to the 0V terminal of this regulator module.

Negative regulator

If you want to provide a regulated negative supply, then the main thing required is to use an LM337T instead of the LM317T (the overlay diagram shows where it is mounted).

You'll also need to replace the BC639 with a BC640 and reverse all polarised components including diodes, electrolytic capacitors and rectifier bridge B1. And of course, if the source is a DC supply its polarity will also have to be reversed. All of the circuit operation applies equally to the negative regulator.

Construction

To mount the components on the PCB, start with the low profile components first and then work your way up to the larger components.

To place the components, look at the overlay diagram which shows how the components and wire links actually appear on the PCB. Read the label of the component, e.g., 'C2', from the overlay and then look up the description next to that label in the parts list. For example, C2 is a ceramic type capacitor and it has the value 0.1uF; it may be marked either 100n, 0.1 or 104.

TABLE 1

Typical values of R2, VR2 (set value, not total resistance) to give various values of Vo (assuming Vref = 1.25V):

Vo	R2	VR2
1.25	0	0
1.5	24	0
3.0	150	18
6.0	430	27
9.0	680	62
12.0	1k	33
15.0	1.2k	120
24.0	2k	180

Begin construction by installing the links and resistors. The resistors can be mounted in either direction, but it is good practice to mount them with their colour codes all in the same direction for ease of reading the values.

One of the resistors supplied with the kit, R0, is actually a wire link. It has the appearance of a 1/4W 5% carbon resistor but has a nominal '0Ω' resistance, and on the overlay it is shown as a resistor.

When mounting the rectifier bridge B1, leave about 10mm of lead length above the PCB so that it can conduct heat away more effectively. The LM317 should also be left with as much lead length as possible, so that it can be attached to a heatsink if necessary.

All of the capacitors except for C2 are polarised types, which will have a negative (-) or positive (+) sign printed on them (normally the negative lead is marked). These must be mounted in the direction shown on the overlay.

When the assembly of the board is complete, carefully check all the soldering. Look especially for dry solder joints, and solder bridges shorting tracks together.

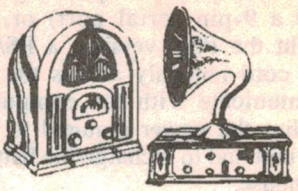
Output connections

If the constant current resistor R3 is not used, it is better to take the output from the metal tab of the LM317T, either by soldering directly or with a lug, rather than from the DC OUT terminal — because this results in better voltage regulation.

If resistor R3 is used, then the output connection has to be made via the DC OUT terminal. ❖

Vintage Radio

by PETER LANKSHEAR



The excellence of Hammarlund

Scandinavia has produced its share of notable pioneering radio engineers, the two best known being the Swedish born Ernst Alexanderson and from Denmark, Valdimar Poulsen. Also from Sweden came the subject of our attention this month, component and receiver manufacturer Oscar Hammarlund.

Very early in the history of radio, it was realised that there had to be better ways of generating RF than by means of high voltage spark discharges — best described as brutal inefficient and spectrum hungry. The aim was to generate a continuous single frequency or continuous wave (CW), something that spark could never do.

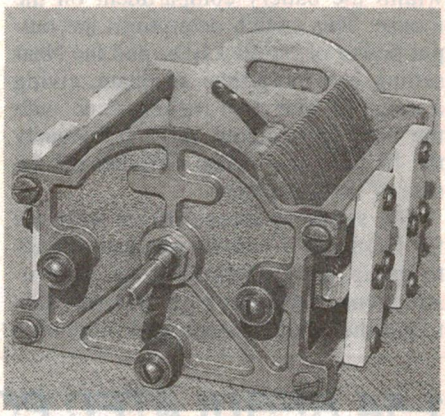
By the 1920's, high powered valve transmitters had become available, but prior to this there was the high frequency alternator which directly and efficiently generated as much as 100kW at frequencies up to 100kHz. Much of the development of these remarkable machines is due to Alexanderson, who went on to become the first chief engineer of RCA. During his long life, (he died in 1975 at the age of 97) he was awarded 344 patents, ranging from electric locomotives to television.

Poulsen was another leader in high powered RF generation, but his work was with arc transmitters. Alternators were understandably very expensive and very large, and consequently relatively few were built. Much more common was the arc transmitter, which generated remarkably pure waveforms by means of an electric arc working in a hydrocarbon atmosphere. By 1919, arc transmitters rated at one megawatt were in use. Incidentally, a graduate Australian electrical engineer, Cyril F. Elwell introduced the Poulsen arc to America in 1908 and subsequently played a large part in its development by the Federal Telegraph Company.

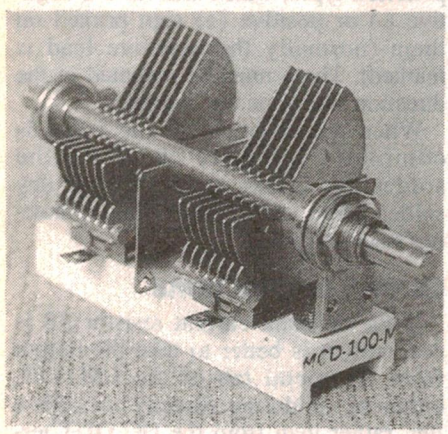
Important as Poulsen's contribution to radio transmission was, his most significant invention, through the lack of a means of amplification, was to remain undeveloped for a generation. But it is difficult to imagine modern technology without it — for it was, of course, none other than magnetic recording.

A third Scandinavian pioneering electronics engineer, Oscar Hammarlund, is rarely credited with his best known invention, the eversharp propelling pencil.

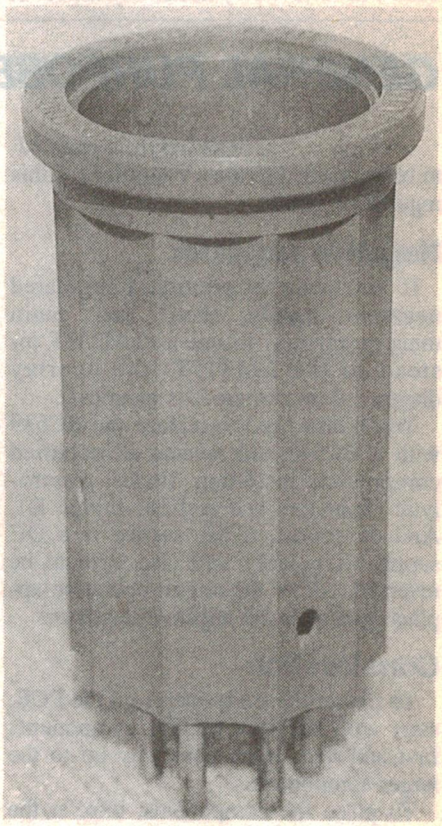
He was born in 1861 in Stockholm, and although his contributions to electronics were perhaps not as spectacular as those of Alexanderson or Poulsen, he was nevertheless a very inventive and skilled engineer, and the firm he founded set for the electronic in-



Hammarlund components made extensive use of Isolantite insulation and finely finished die castings. The splendid TCD split stator transmitter tuning capacitors were an established design by 1932, and the range remained in the catalogs for many years.



There was an elegant simplicity about Hammarlund design that withstood fashion changes. Although this dual 100pF MC-D-100-M variable capacitor is over 50 years old, it would not look out of place in modern equipment.



For generations of hams and shortwave enthusiasts, the Hammarlund Micalex plug-in ribbed former was the ultimate for small coil construction.

dustry, high standards of excellence in component design and quality.

Moved to America

Hammarlund completed his education with a distinguished academic record and, already demonstrating considerable engineering ability, he joined the well known Swedish firm of L.M. Ericsson Co. as a special tool designer and inspector of electrical instruments. However, it was not long before he was invited to go to America to do similar work for the Elgin Watch Company. This he did, in 1882.

Oscar Hammarlund's work with Elgin was noted by Western Electric and in 1886 he was appointed Superintendent of the W.E. plant in Chicago, a considerable responsibility for a 25 year old. Six years later, he went to the Gray Telautograph Co.

It is not always realised that Bell applied for the patents of the telephone only narrowly ahead of Elisha Gray. Gray was a capable engineer and in 1892 was developing the Telautograph, an instrument for transmitting writing electrically and therefore a forerunner of the fax machine.

It was in the process of investigating stylus problems for Gray that the automatic lead pencil was invented by Hammarlund.

Given his technical and engineering talents, it is not at all surprising that Oscar Hammarlund took a keen interest in the new technology of wireless telegraphy. In 1910 he founded a company to develop his ideas.

As the radio industry expanded, the outstanding quality of Hammarlund Manufacturing components made them up-market standard setters. But as well as producing fine components, the Hammarlund Company achieved an number of important 'firsts', including the first commercially produced shortwave superheterodyne communications receiver, the ancestor of a long lived line which were the finest of their type available.

Although catering for a different market from that of the budget conscious broadcast listener, the Hammarlund company had competition — one worthy rival being the National company under the able leadership of James Millen.

It will be recalled that in our November 1994 column, we described the very successful 1924 Browning Drake receiver and how it came to be closely associated with the National company, who produced a long series of very popular receivers, including in 1934 the landmark HRO.

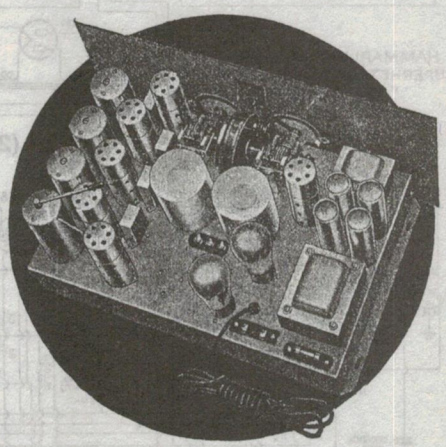
Competing with National

National's success with the Browning Drake did not go unchallenged, and in 1925 Hammarlund responded with the Hammarlund-Roberts kitset receiver. Like the Browning Drake, the Hammarlund-Roberts comprised a neutralised RF stage, a regenerative detector and two audio stages; but there were significant differences. The Hammarlund RF amplifier was simpler to neutralise, and regeneration was controlled not by the 'regenaformer' variometer, but the superior, and more accurately adjustable variable capacitor method.

Like the Browning Drake, the Hammarlund was a simple but efficient design, and many old timers insist that it was superior to the Browning Drake. However, the audio power output of the early radios was never very great and the Hammarlund-Roberts receiver was soon upgraded to a five valve set with push pull output.

VALUE • AND • ECONOMY

The Lowest Priced COMPLETE Short-Wave Superheterodyne



REMEMBER when spare tires, bumpers, horns, etc. were automobile *accessories* — purchased *separately?*

Today, you expect them as *standard equipment.* You would resent being compelled to pay extra for them.

Just so with radios. To own a short-wave receiver comparable in any way with the COMET "PRO" — in quality, range and performance, you must buy or build a perfect tuner, an adequate power supply, a complete set of coils, special transformers, etc. These will make your receiver cost more, in the end, than if you bought the COMET "PRO" *complete,* with all "accessories" *built-in* and scientifically matched to the receiver.

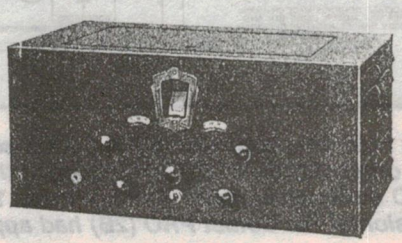
The list price of the COMET "PRO" is $150 (*less tubes*). *But it won't cost you that much!* As a recognized amateur, you are entitled to a discount of 40 and 2 percent, which reduces the price to $88.20 plus a small Federal Excise Tax. That price includes not only a tuner, world-famous for its sensitivity and selectivity, but also a built-in power-pack, air-tuned transformers, and all coils needed to cover a range of 15 to 250 meters, with *band-spread tuning at all frequencies.*

Besides, your dealer can probably arrange easy payments, if you request it.

Think it over, and you'll buy the COMET "PRO" — not only on the basis of its unexcelled *performance,* but also for its unequalled *value* and *economy.*

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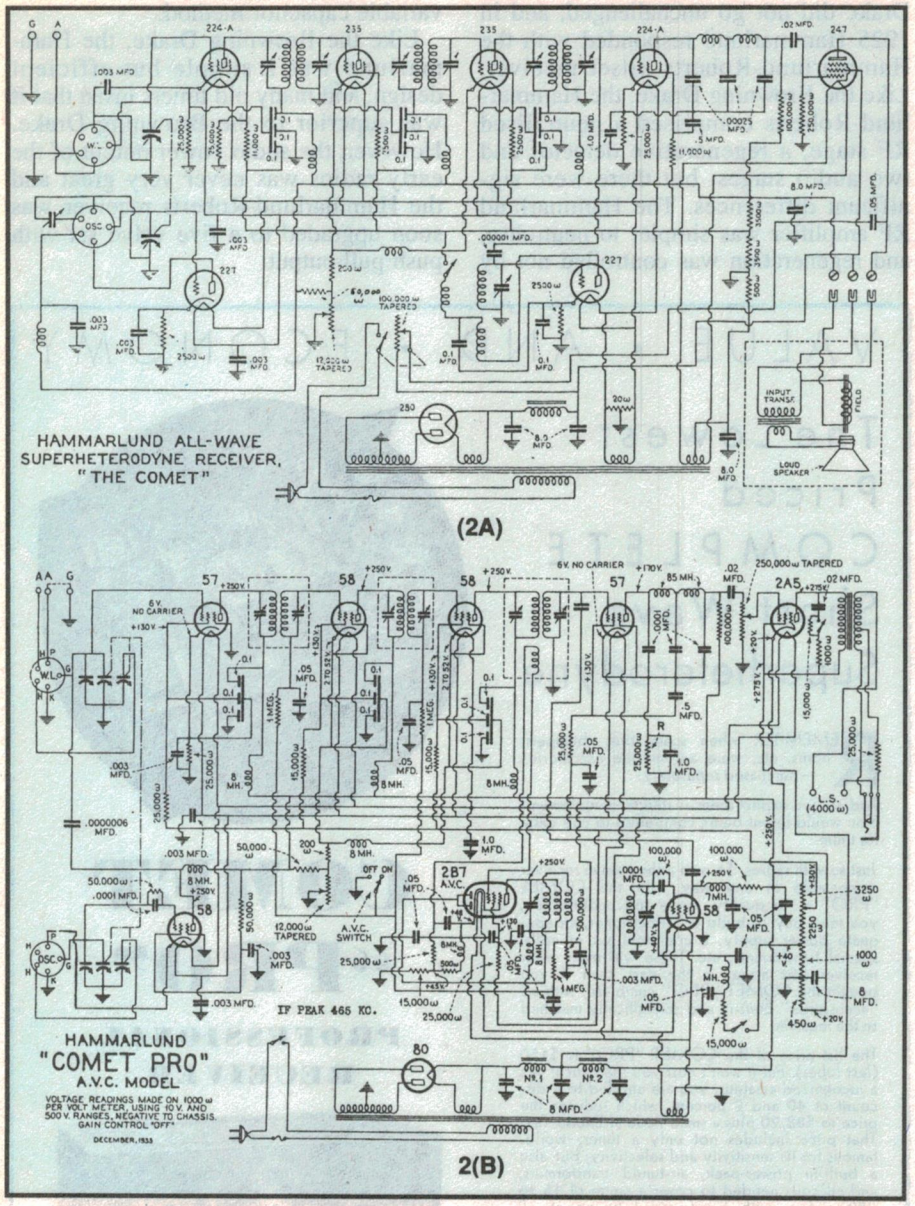
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Say You Saw It in *QST* — It Identifies You and Helps *QST*

This advertisement appeared in QST for August 1933. The comments about purchasing a complete radio (but still less tubes!), was aimed at National, who kept the basic price of their FB7 competitive by selling coils and power supplies as optional extras.



The rapid development of the Comet series is evident from these circuits, with the original Comet (2A) introduced at the beginning of 1932 and the first Comet PRO available in April. By November 1933, less than two years later, the final version of the Comet PRO (2B) had appeared.

Following these successes, Hammarlund Roberts Incorporated as the firm was now called, produced more or less annually a series of receivers, optionally as kitsets or assembled and in cabinets. They tuned only the broadcast band and their circuits were typical of current practice. Most models had the prefix Hi-Q — referring no doubt to Hammarlund's highly efficient coils — and they naturally incorporated the company's premium quality components.

The first model was the 1926 'Hi-Q', a fairly conventional neutralised TRF with two RF stages, detector and two transformer coupled audio stages. The second two tuning capacitors were ganged. It was followed in 1927 by the 'Hi-Q Six', a similar set but with an additional RF stage and using grid resistors for stabilisation of the RF valves.

During 1928 there were at least six 'Hi-Q 29' models, by now using the new screen grid RF amplifier valves with either two or three stages, and with a choice of transformer or resistance coupled audio stages.

Several versions were fitted with mains power supplies. One, the 'Junior' was a hybrid, requiring a lead-acid battery for the valve filaments, but the AC models used the newly introduced indirectly heated valves.

Two Hi-Q 29's had the unusual and short lived Arcturus indirectly heated valves with 15 volt carbon heaters! One distinguishing feature of some of these models was the tuning of both windings of the RF coils, providing band pass coupling.

Last of the HI-Q line

For the 1930 season there were — surprise — the three 'Hi-Q 30' models, including AC and DC mains powered and a battery powered chassis. With six ganged tuning capacitors controlling preselector tuning and three tetrode RF stages, they were examples of the ultimate development of TRF technology. About the only significant feature absent was automatic gain control, but this was rarely seen in TRF receivers anyway. It is obvious from the illustration that these receivers were by now so complex that only experienced builders could tackle the kitsets.

The situation was now changing significantly. During 1930, RCA were obliged to release the superheterodyne patents and it was apparent that radical changes in the radio industry were taking place. At the same time, the Great Depression was paralysing commerce, so that in some respects 1931 was a year in limbo.

Hammarlund made some nominal changes to the Hi-Q 30, to produce the single model AC powered 'Hi-Q 31'. This was to be their last TRF, and the end of the Hi-Q series. Some years later there was a revival of the name in their HQ family of budget priced receivers, which were popular with amateurs worldwide.

There was, however, one field where the TRF was still practically unchallenged. Conventional superhets were considered to have serious shortcomings for shortwave work. Inadequate mixer and oscillator design meant that they were noisy and difficult to tune, and with the commonly used 175kHz intermediate frequency there were serious image problems. Converters were receiving some acceptance by shortwave broadcast listeners, but for amateur and communications work, the standard receiver remained the TRF with a tuned RF stage, regenerative detector and simple audio amplifier.

As has been mentioned in previous

columns, these simple receivers should not be underestimated. For CW (Morse code) reception, the oscillating detector is remarkably efficient. As late as the outbreak of World War II, Pan American Airways were still using similar receivers on their prestigious China Clipper flying boats operating on the San Francisco — Manilla — Hong Kong route.

Theoretically, there was nothing inherently wrong with the superheterodyne that proper design could not overcome. Wisely avoiding the temptation to produce yet another broadcast band only receiver in an over supplied market, Hammarlund in 1931 went to work instead on a shortwave superheterodyne.

Meanwhile in Chicago, during that same year, New Zealander E.H. Scott had produced his massive 12-valve 'All Wave Superheterodyne'.

Probably the first commercially made shortwave receiver, the beautifully made Scott did not have ganged tuning or double tuned IF transformers, features which were included in the new Hammarlund design.

The Comet

Called the 'Comet', Hammarlund's new receiver was announced at the end of 1931, and now there was no kitset option. Using 'in house' components made with Hammarlund precision, the Comet's quality was of the highest order, and with the extensive use of Isolantite insulation, efficiency and stability were good. Images were reduced by the use of what was then a high frequency IF of 465kHz.

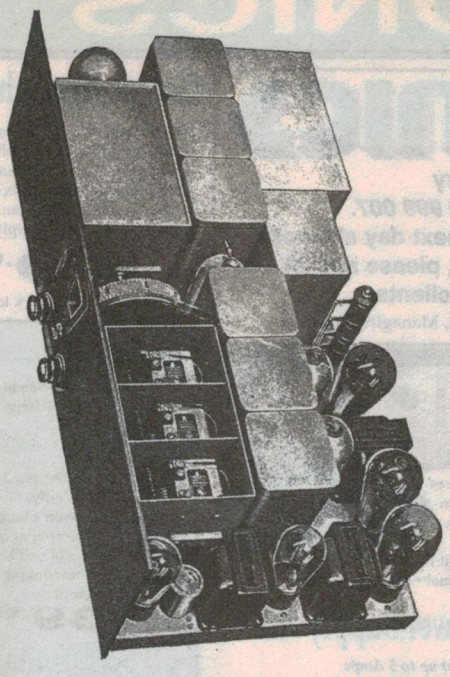
The circuit consisted of a 24A screen grid mixer, inductively coupled to a type 27 triode oscillator. There were five pairs of plug-in coils to cover the range from 550kHz to 21MHz. Tuning was assisted by means of an oscillator bandspread capacitor.

There were two IF amplifier stages using the new variable-mu type 35 tetrodes, and another 24A operating as a biased detector drove the recently introduced type 47 output pentode. One significant feature was what was called the 'IF oscillator' — known better today as a beat-frequency oscillator (BFO).

First of the 'pros'

The Comet was an instant success. Its performance was a revelation, and it was adopted by several large national and international organisations.

Inevitably its communications potential became apparent and by April 1932, the Comet had been adapted for communications work. Not that many modifications were needed.



The Hi-Q 30 was far more complex than most kitset TRF receivers. In this picture from 'Radio News' for December 1929, one of the shield covers has been removed to show how two three-gang tuning capacitors were coupled together as part of the complex tuning system.

Extra tuning capacitors were added and a metal front panel fitted. The main tuning capacitors were used for band setting and were no longer ganged but tuned independently, enabling the oscillator to be operated either above or below the signal frequency. To simplify operation, there was now ganged bandspreading for the aerial tuning and oscillator.

Finally, the audio stage was changed to an indirectly-heated type 27 general purpose triode. This developed less hum than the directly heated 47, and the reduced output was considered adequate for headphones or moving-iron loudspeakers.

If more audio was required, a self-powered unit containing a power pentode and moving coil loudspeaker was available, intended to be driven from the headphone socket.

Called the 'Comet PRO (for Professional)' the new improved receiver continued the success of the Comet. The company must at this time have severed its Roberts interests, as the name was now the Hammarlund Manufacturing Company.

Improvements were steadily made. By December 1932, the RF tetrodes and the triode oscillators had been replaced by the new 57 and 58 RF pentodes, and in the output stage, the 47 pentode was reinstated. The coils were now shielded and the oscillator was capacitively coupled to the mixer.

Throughout 1933, improvements continued, and by the end of the year, the top of the line PRO had a crystal filter, variable BFO, air tuned IF trimmers, an indirectly heated output pentode and automatic gain control.

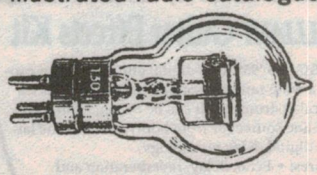
Other manufacturers had understandably not taken the Hammarlund success lying down. Significant competition came from arch-rival National's superheterodynes. Their very expensive AGS was available within three months of the release of the Comet PRO, and at the beginning of 1933, amateurs could buy the economy priced National FB7 with an equivalent specification to the PRO.

The communications receiver had come a long way in two years, but time was running out for the Comet — because, as related in our November 1990 column, National's HRO was introduced at the end of 1934. Although expensive, the HRO was an instant favourite and so advanced that all competition, including the Comet PRO, was immediately obsolete.

The Comet was still a fine receiver, with thousands in daily use, but its days were numbered. Hammarlund set about developing the PRO into a line of superlative receivers, which remained in production for over 30 years and which became a benchmark for performance. But that story will have to wait until next month. ❖

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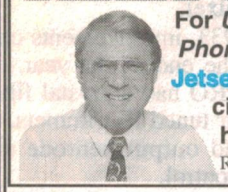
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M 9120 12V AC Plugpack to Suit **$12.95**

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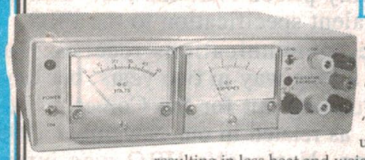
(See EA Jan '85) Our most popular power supply kit. Offers excellent value and performance. Features a variable output of 3 to 30V DC and 0 to 1 Amp current limiting. Ideal power supply for the experimenters, hobbyists, technicians etc.

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Build one of these surround sound simulators and envelope yourself with the stunning realism and dramatic sound impact available from surround encoded videos and TV transmissions.

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Be Quick - Only 60 Left

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NEW



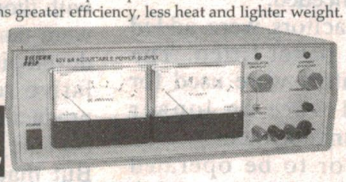
(See EA May '95) New and improved version features re-designed circuitry. Supplied with a case, transformer input/output sockets and high quality silk screened and punched panels - no complicated holes to drill or file. Simple to build and connect.

K 5588 **$69.95**

Adjustable 0-45V, 8 Amp Bench Power Supply Kit

(See SC Jan/Feb '92) Using state of the art circuitry this supply will be a great asset to the enthusiast and professional alike. It uses switch mode principles which allows for smaller transformers, and heatsinking which means greater efficiency, less heat and lighter weight.

Features: •Variable output •Variable current limit •Separate Earth Terminal •Individual Volt and Amp Meters •Constant 13.8V setting •Short circuit proof



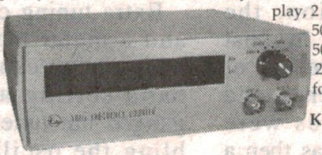
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Limited Stock at This Price! Save $50

(See SC Feb '94) This compact 200W Inverter can drive many mains power appliances including power tools, fluorescent and incandescent lights, TV's etc, using a 12V power source. It is ideal when camping, on building sites, on farms or as part of a solar power installation. This inverter, uses high frequency switching techniques which eliminates the need for bulky, heavy transformers enabling a very light weight compact unit.

Features: • Small physical size • Very low standby current • Modified square wave output • Peak-peak voltage equal to mains sine wave • Low battery voltage shutdown • 30A - over current limiting • Fuse protection • Fully isolated output for safety • 2kg mass

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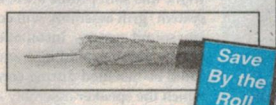


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Quality 75 ohm coaxial cable suitable for TV, video, radio antennas etc. Single strand single centre conductor with copper braiding.

W 0222 100m Roll, Normally $70, **This Month Only $35 per 100m Roll**

Fantastic Ultra Sonic Cleaner

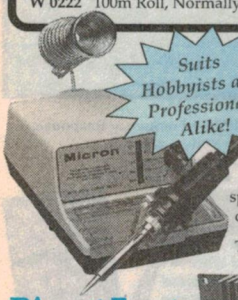


Altronics commitment to quality at direct imported prices means you save $$$. We have managed to secure this year's shipment of Ultra Sonic Cleaners cheaper than 1993. The Pin Point Ultrasonic Cleaner uses a transducer generator to produce millions of activated microscopic cleansing bubbles which blow dirt, grease and grime off surfaces, and penetrate deep into cracks and holes. This personal ultrasonic cleaner won't scratch precious jewellery or glass. Tank size 150 x 90 x 55mm approx.

A 0100 Normally $219.00, **This Month Only $199**

Gently cleans Computer Connectors, PCB's, Switches, Relays, Jewellery, Glasses, Watches, Fuel Injectors and other Very Fine Parts.

Micron Soldering Station



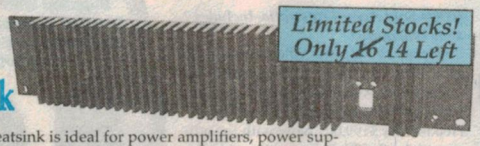
Suits Hobbyists and Professionals Alike!

Electronic Temperature Controlled, Temperature Selectable, Soldering Station

Features heavy duty 60 watt element, variable temperature control (320° to 440°C), LED bargraph temperature readout, quality silicon lead, light weight handle, sponge tray, and super heavy duty iron clad tips etc. Range of tip sizes available.

T 2440 $169.95

Diecast Front Panel Heatsink



Super heavy duty, this heatsink is ideal for power amplifiers, power supplies etc. Features cut-out for a power switch and two LED's.

As Used in Several EA and SC Amplifier Designs

HX5000 Normally $99, **This Month Only $49**

Super Compact Car / Motorcycle Alarm



Exclusive to Altronics

Super compact in size, this alarm features shock sensor (with adjustable sensitivity), voltage drop sensing (can be disabled) and negative trigger input (for door, boot and bonnet etc). Wireless remote control with arm/disarm and panic functions. Will flash car indicators or park lights when arming and disarming. All the electronics and piezo siren are housed inside one neat enclosure measuring only 100L x 75W x 45H mm, making it ideal for cars and motorbikes. Supplied complete with a flashing dash mounted LED and wiring harness.

Protect your car from theft. Install one of these alarms & save hundreds $$$ on comparable systems!

Features

• Remote controlled (≈15m range) • 110dB piezo siren built into controller • Very compact size • Voltage drop sensing circuit (selectable) • Audible arming / disarming with trigger indicator • Built in adjustable shock sensor • Remote panic • Negative trigger input • Triggered memory • 30 second reset and rearm after triggering • 25 second arming delay • 10mA current draw in armed mode

S 5210 Alarm Only **$99** **S 5211** Additional Remote Control $16.95

Professional Gas Iron Kit



Save Over 30%

The advanced *CADIK* Soldering Iron offers a convenience and a range of functions that redefine the limits of soldering. This kit consists of the *CADIK* Gas Soldering Iron supplied in a handy carry case with a range of tips and accessories.

Features: • See through gas chamber • Built in ignition cap • Uses standard butane gas • Supplied with safety stand, cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter

T 2502 Normally $74.95, **This Month Only $49.95**

Limited to 100 Units Only at This Price!

Altronics Retail Store Perth Now Open All Day Saturday! Saturdays 8:30 to 4:00

Professional 4 Sector Digital Alarm System with Auto Dialler



Amazing Value! As used by Many Commercial Alarm Installers Australia Wide.

This alarm panel is the same type as used by many commercial alarm companies to protect both residential and commercial properties.

Incorporating an inbuilt Austel approved auto-dialler, this great alarm can be configured to automatically dial two preset numbers in the event of an alarm, i.e. could be configured to automatically ring a neighbour or an alarm monitoring company. The main controller circuitry is housed in a sturdy steel cabinet. Provision is made to house an optional back up battery if required. The keypad control unit is generally located at the front door for easy access to arming and disarming of the system. The entire system is controlled and programmed via this keypad. Virtually any type of sensor can be used with this system. A combination of normally open and normally closed sensors can be used on any zone. Each zone is monitored by end of line resistors to maintain system integrity, i.e. if someone interferes with the system wiring the alarm will sound immediately.

Features: • master code and three adjustable user codes • monitor function which test features like battery backup and mains failure • four individually programmable sectors with a large array of functions available • all four sectors utilise extensive noise protection circuitry and end of line resistors for added security • once triggered the alarm has the option of a silent alarm, and dialling a friend or monitoring company • quick arming option • zone bypassing for sectors which are false triggering • bell test - to test the external sirens without dialling out • door chime mode for entry/exit paths • battery backup • home or away operation • accessible alarm memory for confirming which sectors were triggered • separate instruction and installation manuals • 12 months warranty

S 5490 $299

M 9140 18V AC Plug Pack with Earth to Suit $32
S 5065 12V 1.2AH Backup Battery to Suit $32.50

PIR Movement Detector

5 Year Warranty

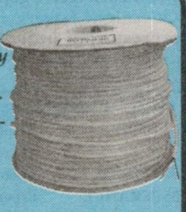
Small and sleek this detector is ideal for the home or the office. Range up to 13 x 13m. **Features:** • LED On/Off Jumper • Vertical Adjustment • Wall/Corner Mounting • Small Size - 62w x 88h x 48d mm • 5 Year Warranty

S 5307 $49

Ideal for the S 5490 Alarm Opposite

Amazing Bonus Package

Over $100 Value of Installation Accessories Including Cable, Strobe & Siren Free with Each Alarm System Purchase!



50 Metres of High Quality 4Core Security Cable (Sufficient for average 4 bedroom house). W 0356



High Intensity Strobe S 5445



Siren Horn C 2015

WARNING
ALTRONICS SURVEILLANCE ALARM SYSTEM FITTED HERE

2 Large Alarm Stickers - S 5400
Plus 4 Window Stickers - S 5410

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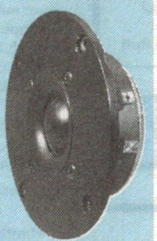
ALTRONICS COMPONENTS

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For many years the premier source for high quality speaker system drivers has been Scandinavia, UK and the USA. Altronics have changed all that with this exciting range of quite superb loudspeakers. As you might expect the Altronics direct import prices allow you a very substantial saving (50% or more!) on our competitor's rates.

JUST ARRIVED - SUPERB QUALITY MAGNETICALLY SHIELDED SPEAKERS FOR YOUR HOME THEATRE

4" Ferrofluid-Cooled Soft Dome Tweeter



Max Power Input: 60w • **Impedance:** 8 Ohm • **Frequency Response:** fo-20kHz • **Sensitivity (1w @ 1m):** 91dB • **Voice Coil Ø:** 25.4mm

C 3005 Normally $59.50,

This Month Only **$50**, or 2 For **$90** ea

5" Woofer



Max Power Rating with Recommended Enclosure (RE): 50 Watts • **Impedance:** 8 Ohm • **Frequency Response:** fo-6kHz • **Resonant Frequency:** 54Hz • **Sensitivity (1w @ 1m):** 87dB • **Voice Coil Ø:** 25.4mm

C 3085 Normally $49.95,

This Month Only **$45**, or 2 For **$80** ea

Recommended Enclosure Designs & Crossover's Available. Please Request by Fax on (09) 328 3487.

6.5" Woofer



Max Power Rating with Recommended Enclosure (RE): 75 Watts • **Impedance:** 8 Ohm • **Frequency Response:** fo-6kHz • **Resonant Frequency:** 42Hz • **Sensitivity (1w @ 1m):** 89dB • **Voice Coil Ø:** 25.4mm

C 3087 Normally $65.95,

Now **$55**, or 2 For **$100** ea

Hi Spec 4" Ferro-Fluid Tweeter Bargain



Max Power Input: 60w • **Impedance:** 8 Ohm • **Frequency Response:** fo-20kHz • **Sensitivity (1w @ 1m):** 91dB • **Voice Coil Ø:** 25.4mm

C 3002 Normally $49.50 ea,

This Month **2 For $49.50**

3.75" Tweeter

2 for the Price of 1 Half Price Bargains



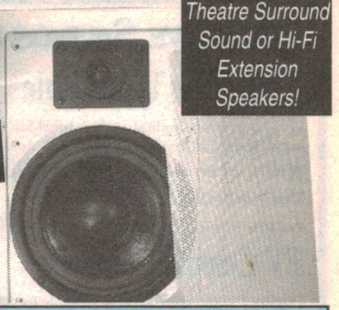
Max Power Input: 40w • **Impedance:** 8 Ohm • **Frequency Response:** fo-20kHz • **Sensitivity (1w @ 1m):** 89dB • **Voice Coil Ø:** 19.4mm

C 3000 Normally $39.50 ea, This Month **2 For $39.50**

Please Note: C 3000, C 3002 and C 3005 Dome Tweeters can safely be employed with speaker systems up to 100 watt power rating with the use of a suitable crossover network.

High Performance 2 Way Flush Mount Ceiling Speaker System

Ideal for Home Theatre Surround Sound or Hi-Fi Extension Speakers!



Save $50 Per Pair

Designed to be installed into ceilings or walls, this slim profile attractive speaker system/grill assembly will compliment any sound system. Installation is simplified by use of mounting frame (which could be installed during construction) which the speaker assembly attaches to. Full mounting kit supplied, including fixing screws. Employs a 165mm (6.5") latex covered driver and a high efficiency polymylar tweeter coupled with a high quality crossover. The grill and exposed surround can be painted to match existing decor.

Highly Recommended. I found it difficult to pick the difference between the Altronics C 0884, the American Sonance and Boston Acoustic Systems both costing around $600.00 a pair
John Negus - Leading WA Audiophile

Specifications: • **Impedance:** 8 Ohm • **Power Input:** 30W RMS • **Frequency Response:** 50Hz - 20kHz • **Colour:** Ivory White • **Dimensions:** =306L x 220W x 86H mm

C 0884 Normally $250 **Per Pair, This Month Only $199 Per Pair**

Aviation Headset



Now Supplied With Doubled Cushioned Headband for Extra Comfort!

This Month Receive a FREE Carry Case Valued at $19.95 Limited to First 100 Callers

1000's Sold Across Australia-Includes 2 Year Warranty!

It was not to long ago when spending $450.00 on an Aviation Headset was not uncommon. Altronics changed all that when we released our C 9070 Aviation Headset for $199.00. Now with the edition of the flexible boom unit and helicopter version (fitted with a Nato plug) our headsets have gone from strength to strength. Add to this enhanced microphone, improved lead shielding and headband comfort these headsets must be the best value for money in Australia!

C 9070 **$199**

This Month Receive a FREE Carry Case Valued at $19.95 - Limited to First 100 Callers

Altronic Dealers Wanted

If you have a dynamic electronics business and would like to sell Altronic Products and Components - We would like to hear from you!

Contact Greg Liddelow at Altronic Distributors Wholesale on (09) 328 2199.

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Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $10.00, 3kg to 5kg is $18.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

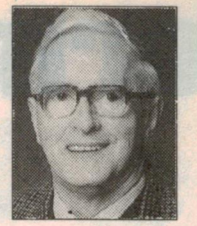
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SHORTWAVE LISTENING

with Arthur Cushen, MBE



Time and frequency stations popular

The shortwave listener is in the unique position that he can get the correct time 24 hours a day on his radio, and also line up his receiver on a frequency that is as accurate as possible, due to the establishment of time and frequency stations in various parts of the world.

The forerunner in this service was the US National Bureau of Standards, with its stations WWV in Fort Collins, Colorado and WWVH in Hawaii. These stations operate on 2500, 5000, 10,000, 15,000 and 20,000kHz and have time announcements every minute. Firstly, the woman announcer identifies WWVH and the male announcer WWV. There are also other items of information between the minute blocks, including weather in the Pacific area and ionosphere predictions.

Australia has also been interested in time and frequency services, and station VNG is well known to listeners in this area. VNG operates on 2500, 5000, 8638, 12,984 and 16,000kHz. Recent improvements in the service have included: in 1994, a new AWA digital announcing machine; a 2kW STC transmitter unit purchased from Radio 2KA in the Blue Mountains; and the purchase of a further 10kW STC transmitter from the National Transmission authority, formerly at Bald Hills, Brisbane.

The transmitters are located on the CAA site at Llandilo, and there has been some speculation as to the future of VNG as the CAA may move its site to Brisbane, but this could be years off rather than months.

The VNG Users Consortium is an active group looking after the interests of VNG and has provided funds towards its continuancy. Secretary Marion Leiba (GPO Box 1090, Canberra) is always pleased to receive reports of the reception, and the areas in which VNG is of help to shortwave listeners.

Japan's JJY

Japan's time and frequency station is JJY. The transmitter identifies with a Morse signal at 13 minutes and 39 minutes past the hour, while a spoken announcement with a female voice is given at 9, 19, 29, 39, 49 and 59 minutes past the hour. Propagation information is also broadcast in Morse. JJY issues verification cards for reception of its frequencies, and most listeners receive the 8MHz signal.

JJY began broadcasting on January 30, 1940 on 4, 7, 9 and 13MHz and was the second station to be launched in the world following the opening of WWV at Fort Collins, Colorado. New sites have been put into operation and today JJY operates 24 hours a day using 2.5, 5, 8, 10 and 15MHz. The output power on each frequency is 2kW.

Another experimental station JG2AS is on the very low frequency of 40kHz longwave, and uses a power of 1kW. JJY, like other time and frequency signals, enables the listener to get an accurate calibration of the frequency on his receiver and also get the time signal which is a standard today of the utmost accuracy. JJY is interested in reception reports and these should be sent to: JJY Communications Research Laboratory, Tokyo 184, Japan.

Looking back

Over the past few months we have had VE Day and VJ Day, celebrating 50 years since the end of the war in Europe and the Far East, and it is interesting to reflect the broadcasting history that was made during that vital period after the war.

In the March 1955 edition, we discussed a new Swiss radio programme in which listeners were asked to make a donation, and the funds raised were given to the International Red Cross. HCJB verified reception of a transmission from its new location at Pifo in Ecuador which in the past 40 years, has been rapidly expanded to be their main transmitting site. ❖

AROUND THE WORLD

ARMENIA: Yerevan has been heard carrying in English the Universal Life Programme, on Mondays at 0330 - 0400UTC on 9665kHz. The station gives an address in Germany and offers verification for reports. The WRTVH also has the address of PO Box 8051, Zurich, Switzerland. After 0400 the station carries the Voice of Russia World Service.

CROATIA: Zagreb has been heard in English 0400 - 0409UTC on 5895 and 7370kHz. This extended English transmission has news in English on the hour from 0000 - 0400. The rest of the programme is a relay of the Domestic Service in Croatian.

ITALY: RAI, Rome is broadcasting via BBC Singapore 1000 - 1100 in Italian, and has moved to 11,704kHz from 11,850kHz due to interference on 11,850kHz from Radio Japan.

MONGOLIA: English broadcasts from Ulaanbaatar are given as follows: 0910 - 0940UTC on 9960 and 12,000kHz; 1445 - 1515 on 7290, 9950kHz; 1940 - 2010 on 11,790 and 12,015kHz; and 0300 - 0330 on 9960 and 12,000kHz. The transmission at 910 is for Australia, and the new frequency of 9960kHz has not been heard due to teleprinter interference.

NEW ZEALAND: ZLXA Levin is now broadcasting Adrian Peterson's Wave Scan on Monday at 0900 and repeated at 2200UTC on 1602, 3935 and 7290kHz. The host of the programme is Kevin Brayshaw who also includes some news for the radio amateur.

PALAU: KHBN has made a frequency change to 9965 from 9830kHz, due to interference from Moscow which is now on 9835kHz beamed to Australia. A phone discussion with the staff indicates that the new frequency is well received in Japan and throughout Asia. Sign on is at 0800UTC in English, then at 0830 in Chinese and English again at 0930 - 1000. Only one transmitter is in operation.

PAPUA NEW GUINEA: Radio Northern Solomons is having a studio built on the island of Buku, with Australian aid. This is the new capital for the Bougainville area and the studio should be ready shortly. A new 10kW transmitter is to be installed near Rabaul, and will carry the programme on 3325kHz — but is not expected on the air for some time.

SWAZILAND: Trans World Radio, in a letter from the Chief Engineer indicates that they are installing a 50kW transmitter which came from Bonaire; this is replacing an old 25kW transmitter of the 1940s. TWR Swaziland went to FM in June and their latest shortwave schedule in English is 0700 - 1035UTC daily on 9500kHz and 1900 - 2130 also on 9500. The transmission from 0701 - 0757 on 11,730kHz comes from Meyerton, South Africa.

TAIWAN: Voice of Free China, Taipeh has English broadcasts daily 0200 - 0400 on 5950 and 9680kHz to North America; on 15,345kHz to Japan and Korea; on 7130kHz to Australia and New Zealand; at 0200 - 0300 on 11,825kHz to Malaysia; on 11,740kHz to Central America; at 0300 - 0400 on 11,825kHz to Indonesia and Philippines; 0700 - 0800 on 5950kHz to North America; and 2200 - 2300 on 17,750 and 21,720kHz to Europe.

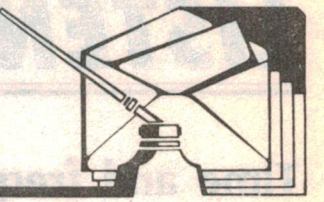
VIETNAM: Hanoi has been heard in English at 1100UTC announcing three frequencies; 7360, 9840 and 15,010kHz. The station has been heard on the new frequency of 9730kHz which gives the best reception.

YUGOSLAVIA: Belgrade's new schedule is 0400 - 0500UTC on 9580 and 11,870kHz to West America; 1830 on 6100, 2100 on 6100kHz and 6185kHz to Europe; 1830 on 9720kHz to Africa; and 0000 on 9580kHz to the East Coast of North America. ❖

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.



Information centre



Conducted by Peter Phillips

Computer crashes, braid breakers and more

This month starts with a sorry but hopefully informative tale about my personal computer system. We then look at some practical aspects of, and a design for a 'braid breaker', followed by the usual questions and comments from readers.

I am preparing this month's column with some difficulty, as my computer system is still recovering from a major crash. Because what happened to me can, and probably will, happen to many Windows users, I've decided to describe what happened.

At the time I had no idea what caused the crash, but I can now see the sequence of events that led it, and the resulting weeks of work to get my computer system back to normal.

The problems started when I first booted my computer (IBM compatible) to start a day's work. The night before I had tried to install a Windows-based MIDI driver for my sound card, but as this had not been successful I had spent the rest of the evening working with a Windows-based word processor.

My system seemed to boot normally, and the familiar Windows interface appeared. However I found that virtually no Windows- based software would run, with Windows reporting that the computer did not have enough memory. As my system has 16MB of RAM, clearly something was wrong. I then found that Windows was running in standard mode (on a Pentium!) and that a few of the icons (including Print Manager and Control Panel) were now duplicated, at the expense of other icons that had mysteriously disappeared...

I was about to contact Microsoft when I noticed that my A and B drives had reversed. That is, if I called up A drive (3.5"), B drive (5.25") would respond, and vice versa. I then checked for a computer virus, but found nothing. Next I checked the BIOS settings, to find they were correct. I decided to reinstall Windows (over the existing files) which changed absolutely nothing.

Next I reinstalled DOS, thinking this might be why the A and B disk drives had reversed. Again to no avail.

As I had previously experienced a few hardware problems with the system, I contacted the supplier. It seemed to me from the evidence that the problem was hardware based, and possibly due to a fault in the extended memory. But the supplier felt the problem was software related, although he was prepared to examine the computer and fix it if possible.

By now I was getting rather desperate, as Windows was refusing to even load, let alone run. I had a rather old backup on tape, but I was still convinced I had a hardware problem, and restoring from the tape would introduce as many problems as it would solve. (Yes, I know, my backup procedures need overhauling!)

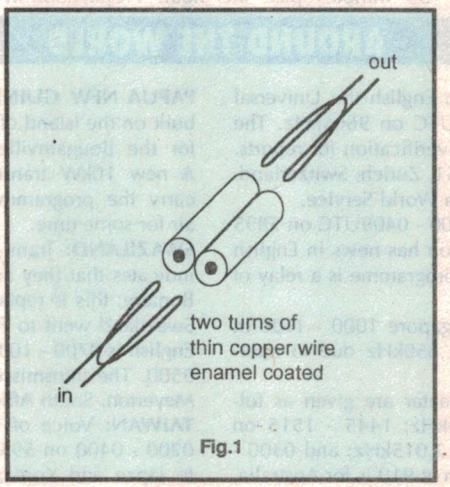


Fig.1

I finally took my computer to a friend who is familiar with problems like this, and we spent several hours researching the cause — finally discovering it was in fact software based. So what was wrong? To explain, here's some history about my system.

I first installed Windows 3.0 some years ago, and since then I've upgraded my computer system three times, as well as upgrading Windows — first to 3.1, then to Windows for Workgroups. As well, I've installed and removed a range of fonts, software packages, drivers and various bits and pieces. In other words, my Windows system has grown like Topsy. Sound familiar?

The problem was simply this. My attempts to install a MIDI driver for the sound card represented the straw that broke the camel's back. After all these years, my Windows system was on the point of collapse, which was bound to happen sooner or later. In short, the only solution was to wipe the system clean and start all over again. That is, everything associated with Windows (drivers, programs, fonts, the lot) would have to be reinstalled.

Naturally I tried a few shortcuts, but I finally had to resort to a complete reinstallation. And make no mistake, this is a huge task — particularly when the system is several years old with lots of Windows-based software and hardware. Virtually all the software, all the drivers (printers, video, sound etc) had to be installed and set up again. It will be weeks before I'm back to normal.

I don't have a solution to what appears to be a common problem with Windows. I've since learnt that it's almost standard practice for better organised users to regularly wipe their system clean and start again. 'Just be warned' is about all I can say. My intention now is to keep a backup of the system at the point when everything is working, but before I start adding anything other than the basics, and to keep it as a starting point in case this happens again. Other than that, I suppose all that can be done

is to be cautious about adding anything that builds more entries in the WIN.INI or SYSTEM.INI files.

Now let's move on, but before we start with the usual content, here's a story related to me recently.

One 'l' or two?

I'm often asked whether my surname is spelled with one 'l' or two. My standard, and by now rather worn out reply is two, unfortunately. But according to an industry source, the now famous Philips brandname used to be spelled 'Phillips'. The story goes that years ago, a bean counter working for the then expanding electronics firm calculated that there were incredible savings to be made by removing one 'l' from the name.

Neon signs will be cheaper and smaller, labels and insignia will be cheaper, it will take a typist less time to key it in, and so on. And when you think about it, the bean counter was right. I wonder, assuming the story to be true, just how much the famous firm has saved over the years from this simple expediency.

Now to some letters from readers, starting with a topic that seems to have generated some general interest, even though it's a rather specialised subject.

Braid breakers

We first started discussion on 'braid breakers' in December '94, along with a general look at baluns. This all started when a reader (Mr R. Kirkham, of Wembley Downs in WA) wrote asking about baluns in general and specifically about a device called a braid breaker. I discussed the issue then and later in May '95.

I have two letters on the subject to present now, the first with a braid breaker design, the next giving some excellent general information about braid breakers.

The original inquiry from Mr Kirkham sought the design of a 1:1 balun that could be used as a braid breaker to remove electrical interference in TV coax. So far, as I described in May, I've been unable to find a suitable design, despite much research. But perhaps this letter might answer the question:

I have read your magazine, under its different names, since 1964 and have constructed many projects with great success. But this is the first time I have written to you. I found the section on baluns in May very interesting, especially as I've had the same problem experienced by Mr Kirkham. And I have a solution that, at least, works for me.

UHF TV transmission was introduced here about three years ago and I therefore rewired my antenna system in 75 ohm coax. The problem now was a 50Hz hum, when I connected the TV audio output to the hifi system.

I traced the hum to the aerial input of the VCR and thence to the TV. Earthing the coax braid, the TV antenna mast or the antenna itself had no effect. Isolation or elimination of the 50Hz signal was required.

The solution was a 1:1 balun. Although I've made a considerable study of the theory, I could not find a suitable design for such a balun. So I dismantled a 75:300 ohm balun and rewound it roughly as shown in Fig.1, using its Neosid core. In other words, it's a sort of RF transformer. I hate to think what it 'looks like' to the antenna, and I have no idea of the impedance, but it works! I don't even know the signal loss.

Can you suggest anything along these lines which would come close to 75 ohms. (Roger Green, Maryborough, Qld.)

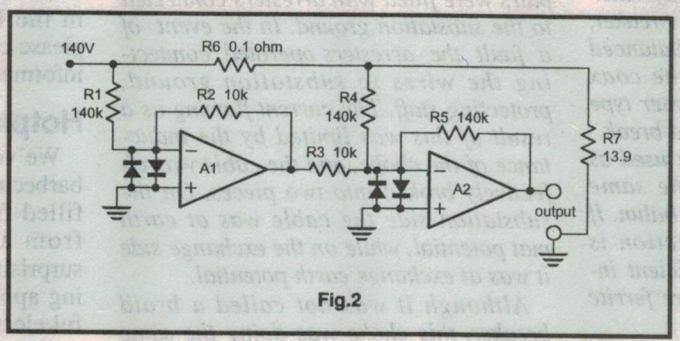


Fig.2

Thanks for this most useful information Roger, I hope Mr Kirkham is reading this, as it could well be the answer he seeks. I assume from your diagram that the balun is wound by poking the wire through one hole of the Neosid former, back to the start around the outside of the core, down the other hole then back around again to the start. This is done for both windings of course.

It's difficult to say if this device represents an impedance of 75 ohms but being a 1:1 transformer, and assuming the secondary load is around 75 ohms, it seems reasonable that it would. So congratulations, it seems you have come up with a simple answer to what has turned out to be a most perplexing problem.

The next letter comes from a reader who has considerable experience in the area, and it more or less speaks for itself. I'm not able to use all of it this month, so I've extracted the section about braid breakers...

First, my credentials. I have worked in the communications industry for 43 years, 36 of them as an engineer, and one of my main specialities was transmission line theory. I have worked with lines at frequencies from 50Hz to UHF and understand the theory and practice well, even if I am now somewhat out of touch.

One thing I have learnt is that the same theoretical principles apply to transmission over all this frequency range, and the claim that 'microwaves are different' is only a half truth. Some components are easier to build at UHF than at 50Hz and vice versa, which means that some designs are more appropriate for specific frequency bands.

I believe on this occasion you have been too ready to accept that there is something peculiar about TV baluns, whereas they are actually pretty simple devices. I made the same mistake at first. As you have found, the literature on the subject is not very helpful and is mostly about amateur radio.

With regard to braid breakers, the concept has a long ancestry in telephony and radio broadcasting, although it is known by different names. Telephone engineers talk of preventing longitudinal to transverse coupling; an obscure subject and, in the absence of texts, one I had to learn from another engineer. Both the articles you quoted in May confuse the functions of baluns and braid breakers, which is not surprising as many devices perform both functions simultaneously.

None of this is any help in Mr Kirkham's problem, and I have little to suggest. I believe that a simple 1:1 transformer with two turns on each winding might do the trick, but that is little more than a guess. (As per our first correspondent, it seems! — Ed.)

A braid breaker is a device intended to suppress undesired signals appearing on the outside of a coaxial cable. There are other closely related devices used in balanced lines and wave guides, but these are given different names.

The need for a braid breaker is more easily explained in the case of a two-wire line. In a two-wire line from an antenna, both wires pick up signals and if the two wires pick up identical signals they cancel out in the transformer which connects the line to the receiver. In practice there

is always some unbalance, which is why two-wire lines can be noisy.

The outside of the shielding around a coaxial cable can also behave as an aerial and pick up or radiate signals. This can cause problems at the end of a coaxial cable where the outside and inside of the shield come together.

The result is that unwanted signals can be picked up by a receiving aerial, or alteration of the radiation pattern of a transmitting aerial. The actual mechanism is sometimes very difficult to recognise and there is not much point going into details about this; just accept that it happens.

The effect is seldom serious, but if necessary it can be minimised by effectively breaking the continuity of the outside of the shielding braid (hence the name braid breaker). A balun in the form of a two-winding transformer performs the function of a braid breaker, providing the centre tap of the balanced winding is not connected to the coax outer. However an auto transformer type of balun does not provide a braid break.

A 1:1 transformer can also be used as a braid breaker, subject to the same design criteria as a transformer balun. If only a small amount of reduction is needed, it's possible to get sufficient inductance by placing one or more ferrite rings around the coax.

One important point about braid breakers is that they are intended to isolate the nominally earthed outer conductor of the coax from the balanced load. Therefore it's essential to make sure there is no inadvertent bypassing of the braid breaking. For example, the coax outer should be kept clear of the metal parts of the antenna it is feeding.

(I'll interrupt our correspondent here to point out that the next part of the letter concerns a less typical, but most interesting use of a braid breaker.)

50Hz braid breaker

A large power substation is a dangerous place, especially when there's an earth fault on one of the feed lines, as the resulting earth currents cause a large potential difference between the station's earth mat and the surrounding area. Telephone lines to such a substation then become hazardous, since they are connected to earth at the telephone exchange. There may be over 1kV difference between the station earth mat and the telephone conductors, so anyone using a telephone during an earth fault can be electrocuted.

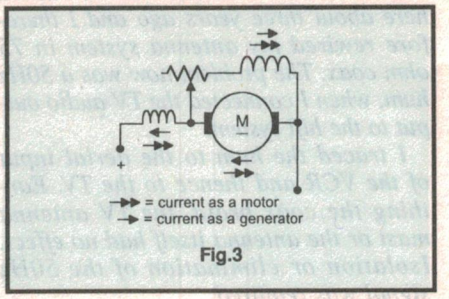


Fig.3

This problem became particularly serious in Sydney around 1970 when three very large substations were built. There was a lot of discussion about safety precautions, and one option seriously considered was an insulated telephone booth. The final solution was a special choke with the windings made up of a length of telephone cable.

At the substation, telephone cable pairs were fitted with arresters connected to the substation ground. In the event of a fault the arresters operated, connecting the wires to substation ground, protecting staff. The current flowing as a result of this was limited by the inductance of the choke, and the cable was effectively broken into two pieces. On the substation side the cable was at earth mat potential, while on the exchange side it was at exchange earth potential.

Although it was not called a braid breaker, this choke was doing the same job. The manhole containing the choke was classified as a dangerous area and staff working in it had to take special precautions. Similar arrangements are needed for cables that run parallel to railway lines that have high voltage AC traction, such as the country lines in Queensland. (Harry Freeman, Wollstonecraft, NSW.)

Thanks for this detailed and informative rundown on braid breakers, Harry. I hope to be able to use the rest of your letter about baluns soon, as it's good to get the story from someone who has worked in the field. It always beats a theoretical approach.

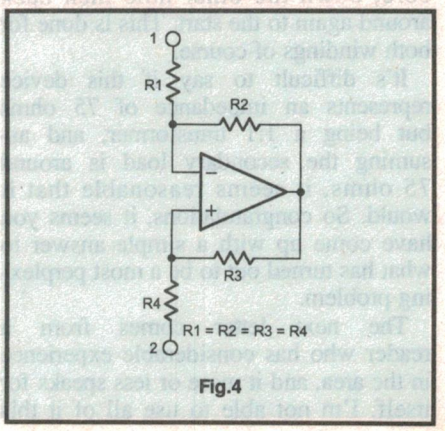


Fig.4

Cassette deck motor

The next letter is one I'm hoping a reader can help with:

I have an AL-85 Alpine cassette deck with a burnt out motor. The motor is a direct drive unit and apparently comes in a module. However it is no longer made, and I was wondering if you could advise me where I might get the motor rewound. Failing that, perhaps you might be able to include this letter in your column in the hope someone has a spare motor I could purchase. Incidentally, the AL-90 has the same motor. (Julius Timmerman, Glenbrook, NSW.)

I don't know of anyone who offers a rewinding service for such a motor, so about all we can do is publish your letter in the hope a reader can help. If so, please contact me and I'll make sure the information is passed on to Julius.

Hotplate charger

We've had letters about using a barbecue to make a PCB, or an oil-filled frypan to desolder components from a PCB, so I suppose it's not surprising to hear of yet another cooking appliance that can double as a useful electronic tool.

First I would like to congratulate and thank you for a great magazine. A lot has been said lately about recharging primary cells, following the availability of commercial and build-your- own dry cell battery chargers. But there's a much simpler and cheaper way to rejuvenate these batteries, which I discovered like this.

The wall clock in my takeaway shop (yes, I'm a technician who owns a takeaway) was clicking, but in vain trying to move forward, indicating a nearly dead battery. So I pulled the battery out and sat its negative end on the hamburger hotplate (handy) for less than a minute, then put it back into the clock. That was four weeks ago and since then the clock has worked perfectly.

I have since done this trick with batteries from transistor radios and torches, but I haven't really experimented with appliances that draw a higher current. It seems any heat source will do the job, but preferably not a direct flame. Perhaps you might like to experiment further with this method and shed more light on it. (Samuel Amatour, Woy Woy, NSW.)

Heating a dry cell to rejuvenate it is an old trick Samuel, although I've not heard of it for some time. I seem to recall that it works best with zinc carbon cells, rather than alkaline types. While I have never researched it, I believe the heating depolarises the anode and brings about enough chemical change to give the battery a bit more life. I agree it would be interesting to see just how much extra life this method does give, and I will try and research it further. Thanks for reminding me of this technique, and also for your kind comments about the magazine.

What?? questions

I seem to include something about a What?? question every column, and this month is certainly no exception. I'll deal with two, in chronological order. The first is from January '95, which was about a series circuit containing a diode, inductor, capacitor, switch and a battery. After closing the switch, the theoretical voltage across the capacitor is twice the battery voltage...

The January What?? gave me some food for thought. Could this be a reason to choose capacitors of a somewhat higher voltage in some circuits? For example, if the circuit is part of an audio amplifier, then the voltage rating of the capacitor should certainly be higher than the source voltage. Is this also the reason why a resistor with a power rating far greater than that required became open circuit in a circuit I built? Do resistors have a voltage rating, and why did it go open circuit? (A. Brooks, North Mackay, Qld.)

When there's an inductor and a capacitor in a circuit, quite a few things can happen, including the possibility of a high voltage. As a student some years ago I joined in the general merriment when a capacitor in a demonstration resonant circuit exploded due to high voltage, much to the lecturer's embarrassment.

But none of this applies to an RC circuit. Here things are much more predictable and as a general rule, the highest voltage in the circuit is the supply voltage. However, you're quite right about resistors having a voltage rating. A high voltage will easily destroy a resistor, as it will most components.

While I can't say it's impossible, I've never known a resistor to go short circuit, as this means the fault has to create a conductive track from one pigtail to the other, usually a distance of at least five millimetres.

Now we turn to the April '95 question, the circuit diagram for which is in Fig.2.

There is a current flow of 10A in resistors R6 and R7 in the circuit you gave for the April What?? question. The total power dissipation is therefore 1400 watts! Is this practical? Also what is the function of the four diodes and what is the value of the voltage supplying the two op-amps? (Greg Beech, Bomaderry, NSW.)

This circuit is part of a protection system, and the load is represented by resistor R7. The load could be anything that takes a current of 10A, which in the circuit is represented by a resistor. The function of the diodes is to protect the op-amp inputs. The diodes clip the voltage between the inputs to +/-0.6V. Most op-amps can only accommodate an input differential voltage of around the op-amp's supply voltage, which is usually no more than +/-18V. Which answers your second question Greg.

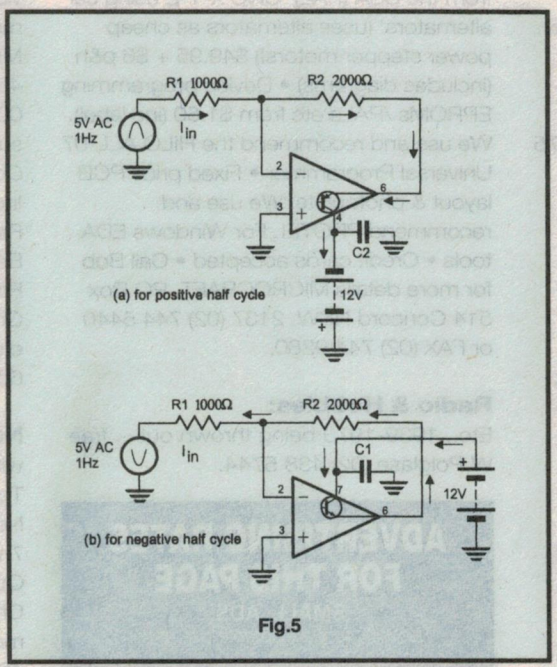


Fig.5

By the way, Greg is the reader who started all the discussion on polarity reversal of a DC generator after being operated as a motor. You might recall the controversy in which a reader stated it was not possible for this to happen. Since then quite a few readers have written pointing out that a compound motor will do just this. Greg now feels quite vindicated, making this comment: *"... so it appears I am not suffering from memory loss. I was beginning to wonder; my confidence has now returned."*

As well, Mr Brooks (from the preceding letter) has alerted me to a mistake in a drawing shown in April '95 (Fig.7) about compound motors. It seems I got the labelling wrong for the motor and the generator currents. The correct drawing is in Fig.3.

What??

You could be excused for thinking I'm hooked on op-amp questions, considering that last month's What?? featured an op-amp, as does this month's. However I think you'll find the question unusual, and certainly different to the July What?? It comes from Joshua Pitcher, who sent it to me in 1992. Somehow it got lost in my filing(?) system, so my apologies to Joshua and my belated thanks for sending it to me. Here's the question:

This circuit is part of a larger net- work for which I had to find the transfer function. I was intrigued by the stage, and thought it would present a challenge to *EA* readers. The question is, what single element does the circuit of Fig.4 represent? Also what is its value. Assume all circuit components are ideal.

Answer to July's What??

Fig.5(a) shows the path of the 5mA input current during the positive half cycle of the 5 volt source. Input current passes through R1, R2, then into the output of the op-amp, through the PNP output transistor and out through the negative supply terminal (pin 4) to the -12V rail. Because the signal frequency is so low, none of it passes through C2.

So all the signal input current must continue on through the negative power supply to get back to ground, thence via the ground connection to the bottom end of the 5V source to complete the current loop. The 1uA current which flows up through the CRO and into the op-amp's output (which is at negative potential) is quite separate.

Fig.5(b) shows the current path for the negative half cycle of the signal source. Starting from the grounded end of the source, the current flows through the ground conductor to the zero terminal of the positive power supply. Then up through the +12V supply to the +12V rail, into the positive supply terminal (pin 7) of the op-amp. From there the input current flows through the NPN output transistor and out of the op-amp output terminal (pin 6), through R2 and R1 back to the 5V source, completing the current loop. ❖

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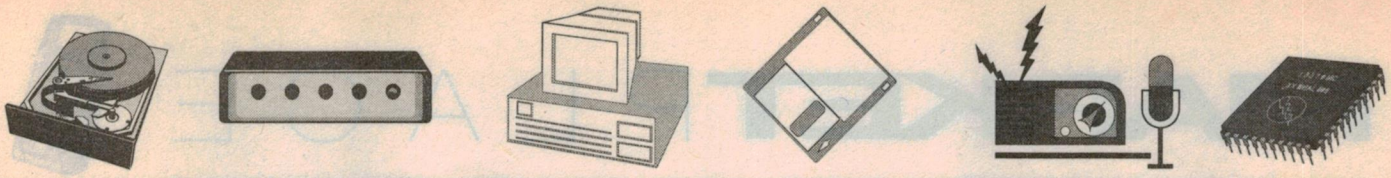
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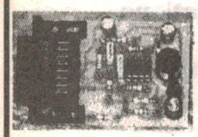
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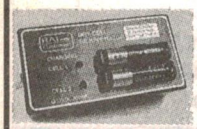
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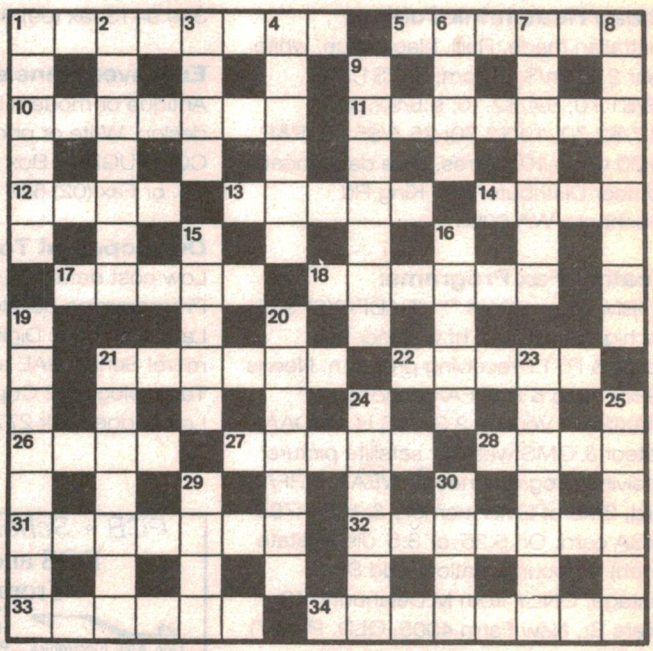
1. Obsolete term for radio receiver. (8)
5. Anechoic rooms do it. (6)
10. Said of crystal with parallel structure. (7)
11. Units of time. (7)
12. Cell with potential for propagation! (4)
13. Equivalent unit to joule per ampere. (5)
14. Jocelyn ——, discoverer of pulsars in 1967. (4)
17. Commit to memory. (5)
18. Elementary particles. (6)
21. Co-inventor with Geiger, Walther ——. (6)
22. Colloquial term for voltage. (5)
26. Type of current. (4)
27. Kind of logical table. (5)
28. Form of lightning. (4)
31. Substance used in pattern making. (7)
32. Charged part of Milliken's experiment. (7)
33. Top electrical conductor. (6)
34. Said of certain telephones. (8)

SOLUTION FOR JULY 1995

S	U	B	W	O	O	F	E	R		T	E	S	L	A
U		I		N		O		H		R		P		N
P	I	O	N	E	E	R		E	L	E	M	E	N	T
R		N		S		C		O		E		C		I
A	X	I	S		S	E	N	S	E		D	I	A	M
		C		F		S		T		W		A		O
S	Y	S	T	E	M		V	A	N	A	L	L	E	N
U				M		O		T		T				I
P	O	S	I	T	I	V	E		S	T	A	T	I	C
E		H		O		E		M		S		R		
R	O	O	T		X	R	A	Y	S		F	A	I	L
C		W		B		H		O		S		F		O
O	V	E	R	U	S	E		P	A	C	I	F	I	C
O		R		R		A		I		A		I		A
L	A	S	E	R		T	E	C	H	N	I	C	A	L

DOWN

1. Another name for chaff. (6)
2. Again put in place. (7)
3. NASA space experiment using laser/radar technology. (4)
4. Part of a connection. (6)
6. Limited range of frequencies. (4)
7. Electrical fittings. (7)
8. No grounds could be reason for faulty transistors? (8)
9. Measuring instrument. (7)
15. Methodical training. (5)
16. Series of soviet spacecraft. (5)
19. Helplessly ignorant (or just blank!). (8)
20. Ceramic iron oxide compound. (7)
21. The electrocardiograph is a —— device. (7)
23. Word in phonetic alphabet. (7)
24. Radio broadcasting room. (6)
25. Parts of wet cell batteries. (6)
29. Close (a circuit). (4)
30. Non-corroding metal. (4)



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VIC RESEARCHER CLAIMS HE CAN PREDICT MAJOR QUAKES BY PLOTTING ELF WAVES

REVIEW OF FLUKE'S NEW 'MULTI PRODUCT' 5500A INSTRUMENT CALIBRATOR

MICROPROCESSORS AND PERIPHERALS FEATURE

EMONA INSTRUMENTS NOW DISTRIBUTING TEK'S EXPANDED RANGE OF HANDHELD INSTRUMENTS, INCLUDING THE THM420 'WAVEMETER' & THE DMM150/CMM150 COMBO





NEWS HIGHLIGHTS

UPS MAKER LEARNS THEIR VALUE

Melbourne firm Anton Piller (Australia) has been manufacturing uninterruptible power supply (UPS) equipment for many years, but the firm's sales promotion lady Eileen Muir recently revealed that until recently, management had apparently not chosen to use the products for protecting its own in-house computers. It was only when a sales engineer's office PC both crashed and was damaged, during a power surge, that it was decided to supply all PC users with UPS units.

However with some embarrassment Ms Muir revealed that a week later, she was busy creating a new advertisement outlining the many benefits of their UPS's when the power suddenly failed — and guess who hadn't yet taken their UPS out of the carton to install it? She apparently had to re-create the complete ad, after finally connecting up the UPS, of course!

QIT'S ANNUAL PROJECT EXPO

The School of Electrical and Electronic Systems Engineering at Queensland University of Technology (QIT) will be holding its annual Project Expo in October, to display its students' final year projects in the areas of avionics, communications, computing, control, electronics, power and signal processing. Many of the projects are described as being in the forefront of current developments, from advances in over-the-horizon radar to the removal of TV commercials. Some have been commissioned by private companies and government organisations.

Further information is available from the Chairperson of the Project Expo Steering Committee, David Nurser on (07) 264 1516.

MOVE FOR AAC

South Australian loudspeaker design firm Australian Audio Consultants has moved to larger premises in Stockport,

EARLY WARNING FOR EARTHQUAKES

A private Australian researcher working in rural Victoria has discovered what he believes is a technology with great potential for the prediction of major earthquakes. The technology involves monitoring earth currents, and results to date have been so promising that Linton researcher George Georgiou has applied for a patent on the system.

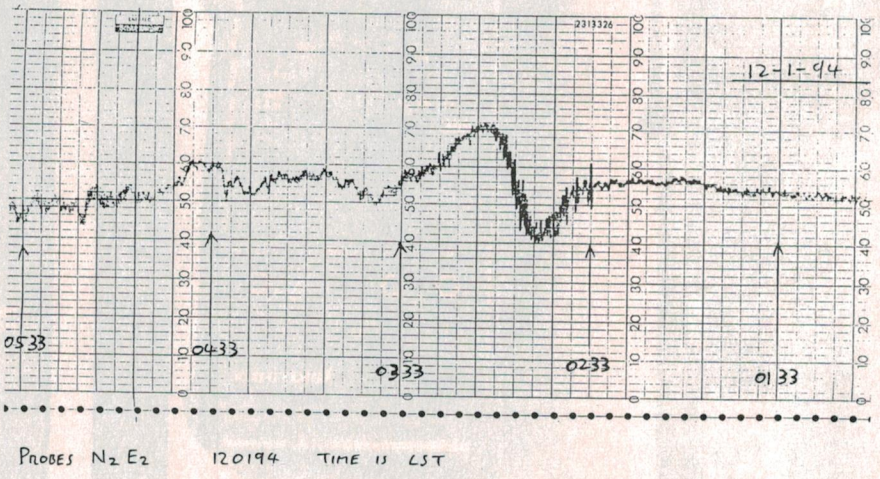
Mr Georgiou has apparently been working on the technology since 1991, experimenting with arrays of electrodes buried in the earth at various depths, spaced at various distances and with different orientations. He has concentrated on studying extremely low frequency electrical transients picked up by the electrodes, and on January 12, 1994 (five days before the Los Angeles quake) his equipment recorded a bipolar transient lasting approximately one hour (see graph).

Since then, further transients have been recorded, and cross referencing with data obtained from the Australian Seismological Centre has provided further evidence of correlation. Recorded transients have been linked with earthquakes in the Middle East, South America — and quite recently, with that on the island of Sakharin in the China Sea.

Mr Georgiou believes more development is needed before the technology will deliver its full potential, and is keen to work with experts and organisations working in the field. He can be contacted via PO Box 60, Linton 3360, or phone (053) 44 7433.



Mr Georgiou with some of his equipment. (Photo courtesy of the Ballarat Courier.)



The recording for January 12th, 1994, five days before the Los Angeles quake. Note the bipolar pulse.

north of Adelaide. The new premises are in a 130-year old church building with 500mm thick stone walls, and are being equipped with acoustic insulation and triple glazing on the windows, to ensure that the loudspeaker testing chamber (5 x 7 x 9m) is free from externally generated noise. The facility is also being fitted with the most modern speaker testing equipment available.

The new address for Australian Audio Consultants is 34 Murray Street (PO Box 11), Stockport 5410; phone/fax (085) 28 2201.

MOTOROLA RESEARCH CENTRE FOR NSW

Motorola, one of the world's leading providers of wireless communications, semiconductors and advanced electronic systems, has launched a new Research Centre in Australia.

The Premier of NSW, Mr Bob Carr MP, officially opened the centre. Guests at the opening included the Treasurer and Minister for State Development in NSW, Mr Michael Egan MP, and the Vice Chairman and Chief Executive Officer of Motorola Inc., Mr Gary Tooker.

Speaking in the opening cermeony, Mr Tooker said, "This is the first Motorola Corporate Research Centre to be opened outside the United States."



Mr Gary Tooker of Motorola.

"We also belive that to be a world leader you need to operate from a truly global platform. The opening of this centre marks the first step in the globalisation of our research network."

The Motorola Australian Research Centre will focus on the development of core technologies relating to wireless communications. This will include wireless and telecommunications systems, radio frequency technologies, networking, multi-media, image and data processing, and various speech technologies.

Mr Tooker said "We believe that the Centre will provide significant benefits to Australia in terms of employment, education and the development of proprietary technologies. We plan to employ 20 to 25 people in the first year of operation and 25 each year after that, This means at least 125 new jobs in the next five years."

The Research Centre will be headed by Leon Jasinksi. Leon has been with Motorola for 27 years and with over 20 patents on his work and a further 41 pending, Leon is one of Motorola's leading authorities in the research and development of technologies for wireless communications.

While in Australia, Mr Tooker also attended the opening of Motorola's

HYUNDAI OFFERS SINGLE CHIP MPEG-2

The Hyundai Digital Media (HDM) Division of Hyundai Electronics America has propelled itself to the forefront of the digital decompression chip market by offering what is claimed to be the industry's most advanced Motion Picture Experts Group (MPEG)-2 decoder solution. The HDM8211M SAVi decoder (SAVi = Systems, Audio, Video) is the first of its kind to integrate the systems, audio and video streams on one chip.



MPEG-2 is the international standard for digital data compression and decompression, and the majority of the world's multimedia content and distribution providers are gravitating to that standard.

"MPEG-2 is the technology that will enable cable operators, telecommunications companies, and direct broadcast satellite (DBS) companies to distribute video-on-demand and other multi-media rich content for the information and entertainment superhighways," explained Jim Kirkpatrick, HDM's general manager.

"We are providing the chip that will make it possible for others to build compact, reliable, low cost MPEG-2 based systems."

Set-top decoder boxes are a primary target for the HDM chip, as well as video CD-ROM players, digital karaoke machines and other similar state of the art multimedia systems.

HDM's SAVi decoder chip is designed to accept compressed MPEG-2 systems, audio and video data streams, sort them by media type (e.g., video, audio, text, private data) then decompress the data before sending it on to a display system. HDM designed the HDM8211M for systems that need to process the digitised video and audio from any source. For example, in processing a video on demand program, the decoder system would have to receive the system stream, parse out the video and audio data, decompress them, and then synchronise the two before outputting.

"HDM built all these in addition to graphics overlay capabilities into the HDM8211M. This makes the chip ideal for set-top decoder boxes, and gives HDM an opportunity at being a leading supplier of MPEG-2 decoder ICs to a market expected to reach 3.5 million units by 1996," said Vahe Akay, director of marketing and sales for HDM.

The first systems to be built based on MPEG-2 technology are expected by the third quarter of 1995. Production is planned to begin around August, which is when HDM will be shipping the HDM8211 SAVi decoder in volume.

NEWS HIGHLIGHTS

Software Centre in Adelaide's Technology Park, by SA Premier Mr Dean Brown MP.

STANILITE WINS $2M GRANT FOR CDMA

Stanilite Electronics has been awarded a government grant totalling two million dollars to assist in bringing to market a new generation telecommunications product. Stanilite's Fixed Wireless Access digital telephone system was judged by the Industry Research & Development (IR&D) Board to be ideally suited to the Board's criteria for its Industry Innovations Program.

The IR&D Board, which reports to the Minister of Industry, Science and Technology, evaluated Stanilite's application on the basis of the market appeal of the developing product and the likely benefit to Australia's export performance. Stanilite's application was supported by the Telecommunications Unit of the Queensland Department of Administrative Services (Q-Tel).

Stanilite's Joint Managing director, Mr John Harriss, said that Fixed Wireless Access has generated enormous interest among telephone service providers around the world "Our product is the first in the world to exploit fully the advantages of wireless technologies and intelligent switching for the efficient provision of fixed telephone services."

The Australian developed product, which will be trialled at live sites in Australia and abroad later this year, uses Code Division Multiple Access (CDMA) techniques to provide unprecedented levels of radio spectrum efficiency, while maintaining a call quality equivalent to that of conventional wireline telephony.

PHILIPS SIGNS LIVE FOR VIDEO CD

Philips Media has reached an agreement with LIVE Entertainment to bring new movie titles to the Video CD format.

Under the agreement, Philips and LIVE will jointly select Video CD titles from LIVE's impressive catalog of more than 2000 movies. LIVE, known for its diverse selection of video titles, markets such home video releases as the Rambo and Terminator collections, Stargate, Basic Instinct, The Crying Game, Reservoir Dogs, Dirty Dancing, The Piano and the animated Teenage Mutant Ninja Turtle series.

"The Video CD format is rapidly gaining momentum in the world wide market place," said Emiel Petrone, senior vice president of entertainment acquisitions for world wide Video CD at Philips Media. "Our agreement with LIVE will go a long way in strengthening our portfolio of titles and atracting attention among consumers."

Philips and LIVE will select the titles for Video CD, starting with the Arnold Schwarzenegger blockbuster hit Total Recall. Philips, which already markets nearly 100 Video CDs in the US and many more abroad, will distribute the LIVE titles through its extensive dealer network. LIVE will produce and replicate the discs.

Philips plans the Australian launch of its Video CDs with its CD-i (Compact Disc Interactive) players in the last quarter of 1995.

VIC HARRIS PASSES AWAY

Well known Australian hifi pioneer Victor F. Harris passed away suddenly on May 31, 1995 aged 75. Mr Harris was the founder and principal of MBH, later known as High Fidelity Products, and designer of the MBH (or 'Hummelstad-Harris') professional pickup, which became widely known and highly respected around the world in the late 1940's and 1950's.

In his long career Mr Harris obtained four patents for various aspects of pickup design, and designed and manufactured many items of professional and domestic audio equipment including recording lathes, turntables, recording and mixing desks, amplifiers and loudspeakers.

Mr Harris is survived by his wife Mary and a daughter. Many of his legion of dedicated customers attended the funeral, and a technical support group is being set up to assist owners of MBH equipment. Enquiries can be directed to Mr Peter Stinson, on (02) 971 8872.

NEWS BRIEFS

- ***GEC Electronics Division*** has been appointed Australian distributor for Micrel, a manufacturer of power supply and driver ICs.
- Cherry Australia has appointed ***Adilam Electronics*** as the National Distributor of Cherry electrical products.
- The Australian telecommunications organisation ***ATUG*** has awarded Ms Beth Jackson with an Excellence in Telecommunications award for her contribution to the communications industry.
- ***Independent Information Technology Training*** is holding a training course called Data Communications Technologies in Sydney 2-4 August '95, and Brisbane 27-29 November '95. For further information phone 1800 654 103.
- The ***1996 Australian Cable & Satellite Television and Conference and Exhibition*** will be held 6-8 February 1996 at the Sydney Darling Harbour Convention and Exhibition Centre. For further information phone (02) 210 5700.
- ***Digital Networks Australia*** has been appointed distributor of Grand Junction switched Ethernet and Fast Ethernet products. ❖

FUJITSU SHOWS 21" PLASMA DISPLAY

Later this year Fujitsu General (Aust.) is planning to launch what it describes as a revolutionary 'next generation' flat screen 21" display for computer or AV use, based on plasma technology. It has apparently received an advance sample of the Plasmavision M21 panel, claimed to be the first to reach Australia.

The panel is only 60mm thick, weighs only 9.8kg and is virtually immune from interference from magnetic fields — allowing a wide choice of installation options, including hanging on the wall or hung from the ceiling. A 140° viewing angle ensures high visibility, and the panel can accept either standard composite video or analog RGB input.

Further information is available from John Green, Director of Sales and Marketing, on (02) 638 5199.

CHINA BUYS NZ TRUNKED RADIO NET

The success of New Zealand Telecom's nationwide radio trunked network in New Zealand has led to China installing a similar network from joint developer Tait Electronics.

The New Zealand wide area trunking network links six main centres, creating a single network allowing raido communications from one end of the country to the other.

Tait has now secured an overseas contract to install a wide area trunking network in China. The system is the result of 2-1/2 years of intensive development in conjunction with NZ Telecom.

A key element of the system is its ability to grow from a series of relatively small regional networks using most of the equipment already in place.

The system operates along the principles of a telephone exchange — a number is dialled, a channel is allocated for the call, and trunking allows the conver-

EMONA IS NEW TEK DISTRIBUTOR

Tektronix and Emona Instruments have signed a distribution agreement for a nominated range of Tektronix products.

Emona Instruments, established for 15 years, has an excellent presence in the markets into which Tektronix wishes to move with the introduction of the TekTools and TekBench product ranges. As a result of the new agreement, Tektronix will offer a broad range of handheld and bench equipment to customers through Emona and its associated distribution network.

For customers this will mean that the TekTools and TekBench ranges will now be available through Emona's network of branch offices and over 50 dealers around Australia. It also means that customers will now be able to source from Emona a complete range of test and measuring instruments catering for almost every requirement in price or specifications.

In announcing the distribution agreement, Alfred Breznik (Snr), Managing Director of Emona Instruments and Peter Roan, National Sales Manager of Tektronix said that they believe this partnership will optimise the resources and strengths of each company, with a special focus on meeting customers' needs.



Peter Roan of Tektronix (left) and Alfred Breznik Snr. of Emona Instruments, after signing the agreement.

sation to be private, unlike conventional mobile radio.

Tait's Trunking Division Manger, Mr Ken Camp said the appeal of the system is its user friendly design.

"The entire system is software based, using SUN workstations which work on around 10 times the horsepower needed to run a PC," he said. "This powerful inbuilt intelligence makes the unit very simple to operate."

FUJITSU SDH GEAR FOR OPTUS

As part of a major ongoing supply deal, Fujitsu Australia Limited will supply equipment and services worth over A$11m to Optus Communications.

Fujitsu has provided equipment and services to Optus Communications since it started the major expansion of its Synchronous Digital Hierarchy (SDH) network, in February this year. Under the agreement, Fujitsu is supplying several hundred Fujitsu Lightwave Multiplexers 2400E (FLM2400E) SDH multiplexers, which operate at 2.5Gbit/s and provide for the carriage of either 32 channels of digital video or up to 30,000 simultaneous telephone calls.

Fujitsu's equipment will form the backbone of the Optus Communications metropolitan and inter-capital trunk networks to provide the carriage of digitial video, telephony and other interactive services.

Fujitsu's success in this deal has established it as major supplier in the emerging Australian cable TV industry. "The network roll out was extremely aggressive, we were able to roll out 2000 kilometres of equipment in three weeks. Projects such as this demonstrate the expertise of our Customer Services Division in project management and project roll out," said Mr Paul Mason, Optus Business Manager, Fujitsu Australia.

The SDH network will initially be installed in Brisbane, Melbourne and Sydney and will provide transport services for three million households in the Optus Vision service areas.

TELSTRA TO TRIAL BROADBAND SERVICE

Telstra has announced the establishment of an Experimental Broadband Network (EBN) which, according to Telstra's Managing Director of Network Products, Gerry Moriarty, "will maintain Telstra and Australia as world leaders in the development of sophisticated communications services technology."

Alcatel Australia is providing four Asynchronous Transfer Mode (ATM) high capacity switches in the EBN backbone. Telstra expected to have up to 30 particpants connected to the network starting from July 1995 (subject to Austel approval).

"Initially these participants will be members of the R&D community and leading applications developers who will trial advanced applications including telemedicine, video on demand and interactive distance education," said Mr Moriarty.

"The EBN will assist Australian companies in developing the wideband communications products of the 21st century with the potential for valuable exports worldwide. The EBN also is a significant step in Telstra's commitment to providing the interactive multimedia infrastructure servicing homes and the education and business sectors."

The EBN, run by Telstra Research Laboratories, is overlaid on Telstra's existing national fibre optic network. The first EBN nodes were installed in Melbourne and Sydney, while Canberra and Brisbane nodes were to be installed in June.

"The implementation of the EBN is a world leading initiative," stated Alcatel Australia's Managing Director Ron Spithill. "It will kick-start the development of Australia's broadband and multimedia industries, and places Alcatel at the forefront of building this infrastructure."

Alcatel Australia is supplying four high performance Alcatel 1000 AX switches, each with more than 40Gbit/s throughput.

The company will also provide connectionless servers for the Sydney and Melbourne nodes, remote multiplexing equipment and a network management packages known as the Alcatel 1370. New interfaces and features are to be added throughout the duration of the trial, which will run for a minimum of two years. ❖

FLUKE'S NEW 5500A CALIBRATOR

Fluke is well known around the world for its high quality measuring instruments, and its calibration equipment is particularly highly regarded. The latest addition to its range of calibrators is the 'multi-product' 5500A, designed for calibrating a wide range of today's electronic and electrical test tools. Thanks to Philips Test & Measurement, our Editor had the opportunity to try out one of these 'cal lab in a box' units for a few days — and now that he's stopped drooling, here's his report:

by JIM ROWE

When you make a measurement with your digital multimeter, and the DMM reading says 5.32V DC — or 75.4mA AC, or 46.8 ohms, or whatever — how confident can you be in that reading? Although the reading of a DMM has good *resolution*, letting you take a reading to three or more decimal places, that's no guarantee of its *accuracy* level.

Like any other measuring instrument, a DMM is built up using components which have their own manufacturing tolerances. This means that before it leaves the factory, the manufacturer has to ensure that it meets the specified accuracy rating for that model, by *calibrating* it against a reference instrument.

So when you buy an instrument from a reputable manufacturer, you can generally rely on its accuracy being within the rated tolerance — when you buy it, at least. But as the components that make up the DMM will also tend to drift in value and/or performance as they age, the accuracy of the DMM itself will tend to drift as well. It may or may not be still within the rated accuracy tolerance a few years down the track; the only way to make sure is by calibrating it again.

Basically, then, calibration involves comparing the instrument's readings with those of an instrument of known accuracy. With the better grade of instrument, fitted with internal calibration adjustments, it's also possible to tweak these (if necessary) at the same time, to bring it within the rated spec.

But what sort of 'known accuracy' reference instrument is used for this kind of calibration? In the old days, it was a collection of hand-made standard cells, lab potentiometers, transfer standards and reference resistors, all locked away in the rarified air of a metrology lab. You sent away your DMM or other instrument, and some time later it came back with a certificate, showing how its readings compare with their reference instruments.

Nowadays, though, instruments like DMMs are generally checked against a specialised instrument known as — you guessed it, a *calibrator*. And as you might expect, a calibrator is a bit like a metrology lab in a box. Essentially it has the ability to provide a range of finely adjustable, very stable and accurately known voltages, currents, resistances and other electrical parameters, for use in checking your instrument.

The logical question here is — how is the calibrator's *own* accuracy checked? And the answer is by calibrating it periodically, in turn, against a 'reference standard' instrument. And *that* instrument is again calibrated periodically against an even better 'secondary standard', which every so often is *also* checked against and even better 'primary standard'. And this in turn is checked against national and international standards...

The key to calibration, then, is that a calibrator isn't just a box that can deliver very stable and finely adjustable voltages, currents or whatever. It's the fact that the calibrator's accuracy is *traceable*, back through a calibration chain which ends up with the accepted national/international standards for the electrical parameter concerned.

In calibration and metrology lab circles, the Fluke company is just as well known for its calibration equipment as it is in the wider sphere of electronics for its other and more general purpose test instruments.

Its reference standards, transfer standards, measurement amplifiers and calibrators are used around the world in standards and cal labs, with the 5700A and 5100 Series calibrators very widely used in primary and secondary standards labs, as well as for instrument calibration in smaller labs and manufacturing organisations.

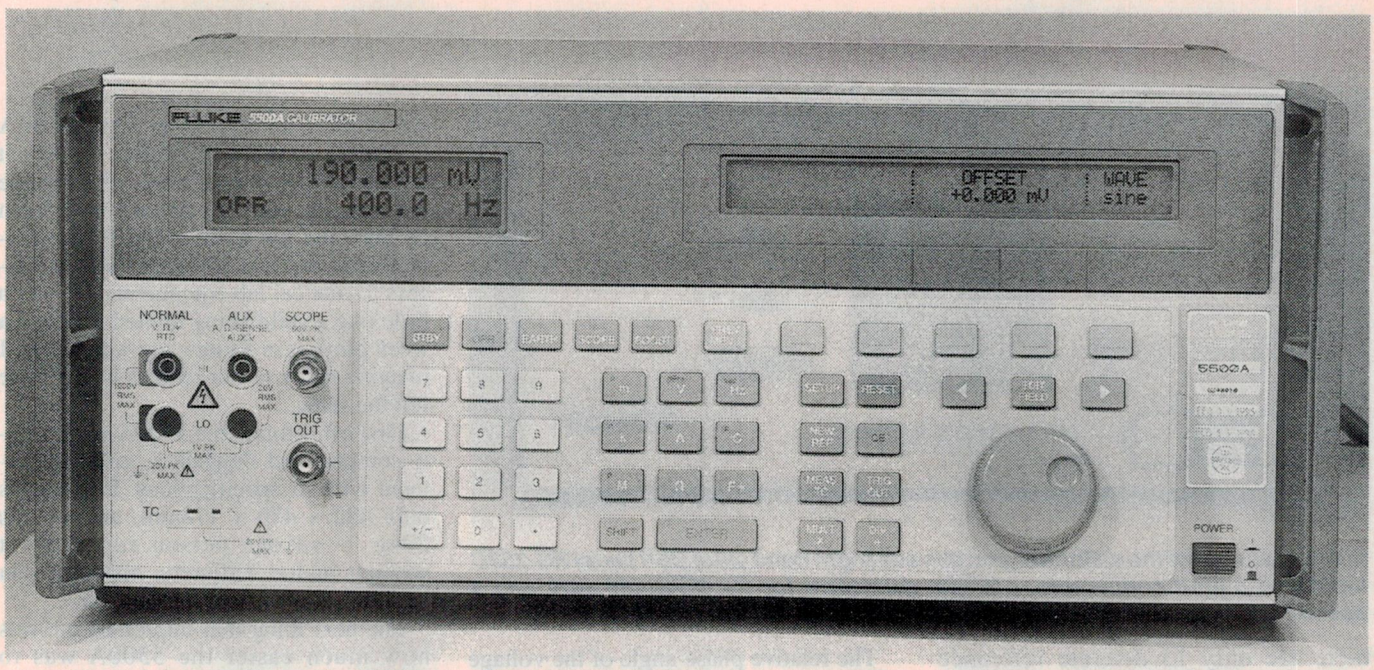
The new 5500A

The latest addition to the Fluke range of calibrators is the 5500A, described as a 'multi product' calibrator because in addition to the DC and AC voltage and current, and resistance capabilities offered by the existing models, it also provides adjustable capacitance (330pF - 1100uF), together with temperature calibration for both thermocouples (nine different types) and RTDs (resistive temperature devices), simulated power measurements for both DC and AC up to 11kW, phase angle and power factor, and frequency. In short, it can be used to calibrate just about every range of a modern handheld or benchtop DMM, along with a wide variety of more specialised instruments such as chart recorders, plotters, thermometers, clamp meters, watt meters, phase and power factor meters and so on. Needless to say it can also be used to calibrate older analog-type measuring instruments, as well.

There's even an optional plug-in which allows the 5500A to be used to calibrate modern measuring scopes, of both the analog and DSO variety.

In short, the new 5500A is even more of a 'cal lab in a box' than its worthy predecessors. And since the base cost of the instrument is somewhat *lower* than these earlier calibrators, this should make it a very welcome addition for many potential users.

The output range and setting resolution of the 5500A in each of its modes is most impressive. For example it can deliver any DC voltage from 0 to 1000V, and for voltages up to 329.9999mV, the setting resolution is 0.1uV. Between 330mV and 3.299999V, the resolution is 1uV; from 3.3V to 32.99999V, it's



10uV; from 33V to 329.9999V, it's 100uV; and from 330V to 1000V, 1mV. The permissible loading of the main output (there are two) for these ranges is 50 ohms, 10mA, 10mA, 5mA and 5mA respectively.

Needless to say the accuracy, or 'absolute uncertainty' as the experts would describe it, of the 5500A is also very impressive. Within 90 days of being calibrated itself, even voltages below 330mV are rated to be within +/-(0.005% + 3uV), with those between 300mV and 3.3V being within +/-(0.004% + 5uV), those between 3.3V and 33V within +/-(0.004% + 50uV), those between 33V and 330V within +/-(0.0045% + 500uV) and from 330V to 1000V within +/-(0.0045% + 1.5mV). And for up to a year from calibration, these rated accuracy figures only deteriorate by a further 0.001% — giving a figure of +/-(0.006% + 3uV) for the lowest voltages, for example.

The performance for direct current is also very impressive. Here you can program it to deliver any current level up to 11A, with setting resolutions ranging from 0.01uA (0 - 3.29999mA) up to 100uA (2.2A - 11A). The rated 90-day accuracy for DC current ranges from +/-(0.010% + 0.05uA) for currents below 3.3mA, up to +/-(0.038% + 330uA) for currents above 2.2A. Again the one-year figures are almost as good, ranging from +/-(0.013% + 0.05uA) for currents below 3.3mA, to +/-(0.06% + 330uA) above 2.2A.

For AC voltage, the 5500A can provide any voltage between 1mV and 1000V, and in this case there's a choice of four different waveforms: sine, square, triangle or truncated sine. The frequency can also be programmed, for any value between 10Hz and 500kHz for most of the range (45Hz - 10kHz above 33V).

The setting resolution on AC voltage ranges from 1uV (between 1mV and 32.999mV) up to 10mV (above 330V). Similarly the rated 90-day accuracy ranges from +/-(0.11% + 20uV) for voltages below 32mV (45Hz - 10kHz) down to +/-(0.02% + 60uV) for voltages between 300mV and 2.29999V (45Hz - 10kHz) and up to +/-(0.04% + 80mV) for voltages above 330V (45Hz - 1kHz).

For AC current the 5500A can deliver any value from 30uA to 11A, again with a choice of four waveforms and with frequency programmable between 10Hz and 10kHz. The setting resolution varies from 0.01uA for currents below 3.3mA, up to 100uA for currents above 2.2A. The 90-day rated accuracy ranges from +/- (0.09% + 0.25uA) for currents below 330uA (45Hz - 1kHz), down to +/-(0.07% + 3uA) for currents between 3.3mA and 32.999mA (45Hz - 1kHz) and up to +/-(0.08 + 2mA) for currents above 2.2A (45 - 500Hz).

By the way, since the 5500A can deliver up to 1000V DC and 1000V RMS AC, and necessarily must provide a low source impedance to maximise measurement accuracy, its output very definitely has the capability of delivering a *lethal* shock. Similarly its ability to source up to 11A into low impedances could also cause embarrassment in the wrong circumstances. Happily Fluke has built in various safeguards to assist in protecting both the equipment under test and the operator, but inevitably one needs to be very careful using this type of equipment...

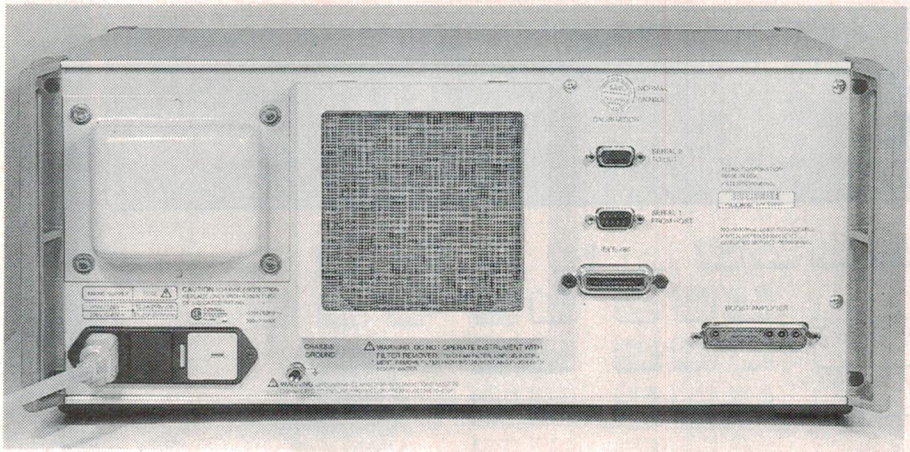
As a programmable resistance, the 5500A can be programmed for any value from zero up to 330MΩ. In this mode its setting resolution varies between 0.001Ω for values below 329.999Ω, through to 1Ω for values between 33kΩ and 330kΩ, finally increasing to 1000Ω for values between 33MΩ and 330MΩ. The 90-day rated accuracy is again most impressive, ranging from +/-(0.009% + 0.008Ω) for values below 10.99Ω, to +/-(0.007% + 0.015Ω) for values between 33Ω and 330Ω, and up to +/-(0.4% + 16.5k) for values above 110MΩ.

Note that the 5500A can provide either two-wire or four-wire lead compensation for resistance measurements below 110kΩ, as well as 'no compensation'.

As a programmable capacitor, the 5500A can provide any value between 330pF and 1.1mF (1100uF), and capable of operating at frequencies between 50Hz and 1kHz. The setting resolution in this mode varies between 0.1pF for values below 3.2999nF, up to 0.1uF for values above 330uF. The 90-day rated accuracy here varies from +/-(0.38% + 10pF) for values below 10.999nF, down to +/- (0.19% + 100pF) for values between 11nF and 110.99nF, and up to +/-(1% + 300nF) for values above 330uF.

In passing, I should perhaps note that the 5500A uses a special synthesis technique to generate its programmable resistance and capacitance values. For example there are only 16 discrete reference resistors in the instrument; these are used to produce any desired value by means of a system of series-connected 'dependent voltage sources'. Similarly

FLUKE'S NEW 5500A CALIBRATOR



In this rear view of the calibrator you can see (right hand side) DB9 serial RS-232C input and output connectors, a 24-pin connector for the IEEE 488 port, and a special connector to interface with the optional 5725A boost amplifier.

there are only 13 discrete reference capacitors, with series-connected depended voltage sources used to synthesise intermediate values. Fluke says that the synthesis system used is compatible with virtually all commonly used resistance and capacitance measuring techniques used in both DMMs and AC-type RCL meters/bridges.

The specifications of the 5500A for RTD and thermocouple thermometer calibration are also very good, but as these are fairly specialised we probably don't need to go into them here. Suffice to say that it can be used to calibrate meters using both RTD's and type B, C, E, J, K, N, R, S and T thermocouples.

To calibrate power meters, power factor and phase angle meters, the 5500A makes use of its dual outputs to simulate the voltage and current components of power taken by a 'phantom load'. For example it can simulate an AC power level of say 10kW at unity power factor (PF), for calibrating a power meter, by providing 1000V RMS at one output and delivering an in-phase 10A RMS from the other into the meter's current input. The power meter therefore registers its best estimate of 10kW, as if the voltage and current were both being applied to, and drawn by, a load — which in reality doesn't exist, of course.

The rated 90-day accuracy of the 5500A for DC power measurements varies between about 0.02% and 0.08% of reading, depending upon the exact voltage and current range combination in use. Similarly for AC power measurements between 45Hz and 65Hz with unity PF, the 90-day accuracy varies between 0.12% and 0.25% of reading, depending again on the voltage and current levels.

The relative phase angle of the voltage and current outputs can of course be adjusted between 0° and 90°, in 0.02° increments, for calibration of power factor and phase angle meters. Needless to say the power measurement uncertainty due to phase angle errors is also defined in the 5500A's specs, and for frequences between 10Hz and 65Hz varies between 0.02% of reading at a PF of 0.996 (5° phase angle) to 2.99% at a PF of 0.087 (85° phase angle).

Of course AC power, PF, voltage, current and other AC measurement ranges can all be calibrated not just using the 5500A's sinewave outputs, but also using its other waveforms — square, triangle and truncated sine. The very extensive specification tables provided with the 5500A include the distortion and noise data for each of the instrument's output waveforms, along with the specs when its optional auxiliary 5725A boost amplifier is used.

Oh, I forgot the specs for the frequency of the 5500A, when it's being used on the AC ranges. On any of these ranges the frequency can be set anywhere between 45Hz and 10kHz, with an extended range of 0.01Hz - 500kHz available on some ranges and up to 2MHz for voltages between 330mV and 3.3V. The setting resolution varies between 0.01Hz below 119.99Hz, up to 1kHz above 1.2MHz. The rated accuracy at one year from calibration is +/-(25ppm + 2mHz) on all ranges, with a jitter of 2us for frequencies below 10kHz and less than 140ns for higher frequencies.

In the 'flesh'

Thanks to the Test and Measurement Division of Philips, we were able to get our hands on the very first 5500A Calibrator to reach Australia, and try it out for a little over a week. For anyone like myself, who has always been keen on knowing the accuracy of their measurements but has never before had access to true cal lab equipment, this was a little like a child being invited to spend a week playing in Santa's toy warehouse. I imagine many of our readers would have felt the same...

First off, I found the 5500A surprisingly compact and 'luggable', for an instrument with its specifications. It measures only 432 x 470 x 178mm, and weighs 20kg — so one person can carry it without undue difficulty, although you wouldn't want to carry it very far.

The next thing that impressed me was how much easier the 5500A was to 'drive', than I had expected. Like most modern test gear it's built around a microprocessor, and as a result programming it to produce the desired output parameter and value turns out to be very simple and straightforward. Basically you just key in the value you want, add the appropriate units (uA/mA/A, mV/V, ohms, uF or whatever), and press the 'Enter' key.

Of course there's often a bit more to it than that, but in most cases the complications are really only introduced for one of two reasons:

(a) To protect the equipment you're calibrating, the user (you!) or the 5500A itself, from damage due to inadvertent operator errors; or

(b) To speed up the actual calibration process in some way, or to ensure that the calibrator is itself working properly.

In the first category, for example, the 5500A has two important extra buttons: 'STBY' and 'OPR'. These control whether or not the calibrator's outputs are 'live', so you can set up a desired output parameter and value in STBY mode, and only have it fed to the appropriate output terminals when the OPR button is pressed. Pressing the STBY button again disables the outputs once more, to allow you to change the settings and/or cables on either the calibrator or the meter under test.

In this context, a nice safety feature of the 5500A is that when you select an output voltage above 33V, it automatically flips into STBY mode, even if you were adjusting the voltage 'on line' in OPR mode. This is to protect the instrument under test from damage, in case you dialed up a high voltage by accident. It's simple enough to press the OPR but-

ton again, if you didn't make a mistake — and if you did, there's an opportunity to correct it!

Yet another nice design feature of the 5500A in terms of safety is the way the various output parameters are 'shared' between its two pairs of main outputs. For example voltage, resistance and capacitance appear at the 'Normal' outputs, while the other 'Aux' outputs are used to deliver current and perform the sensing for compensated resistance measurements. Clearly some of these parameters have to be separated anyway (e.g., to enable power measurements), but the separation also reduces the risk of damage due to the operator forgetting to change over the connections — for example when moving from current calibration to voltage!

Needless to say, both pairs of output jacks are of the fully recessed and shrouded type, again for safety reasons. Another nice safety feature is that if the 5500A senses on current ranges that the compliance voltage (voltage necessary to produce the programmed current in the meter) is too high, it again automatically flips into STBY mode, and displays an error message — in case you've forgotten to switch to the correct range on the DMM (and you probably have!).

An example of the second kind of 5500A control elaboration, in the interests of 'calibration convenience', are two extra buttons labelled 'MULT' and 'DIV'. These are very handy indeed, because they allow you to either multiply or divide the current nominal output of the calibrator quickly by a factor of 10 — the usual range multiplier on most instruments under test.

But why did I write 'nominal value' in that last paragraph? That leads to another very nice feature of the 5500A, associated with the rotary control knob you can see in the photo, near the lower right-hand end of the front panel.

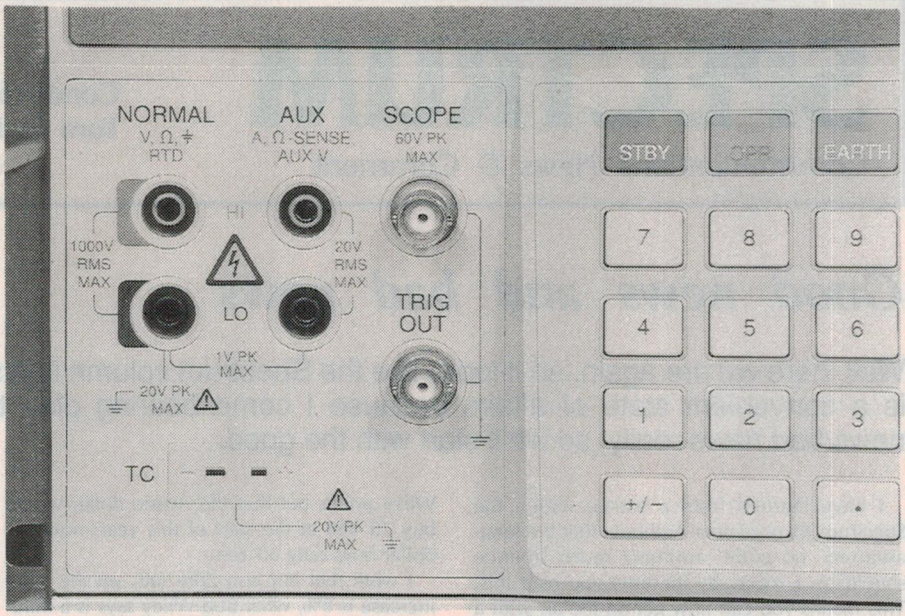
Let's say you want to check the DC voltage calibration of a DMM, at 1.900000V. You punch in '1.90' and 'V', then press 'Enter', and finally (assuming the DMM is hooked up by suitable cables, and set to the correct range), you press the OPR button. The DMM then reads say 1.898V. So how far out is it — is the error within the DMM's spec?

Before you reach for your calculator, there's no need. The 5500A will work it out for you; all you have to do is watch the DMM's readout, and slowly turn the 5500A's rotary knob one way or the other (depending on the error) until the DMM reads exactly '1.900' or whatever is its highest resolution equivalent. Then you simply glance back at the 5500A's auxiliary display panel (on the right-hand end), and this will show you the DMM's error directly in either parts per million (ppm) or as a percentage of the programmed nominal value. How's that for user friendliness?

(By the way, the error here would be -0.1%.)

Incidentally, a pair of cursor keys allow you to allocate the rotary control to any particular digit of the programmed nominal value, so that you can vary its adjustment resolution to suit the resolution and accuracy of the instrument under test. This avoids having to turn the control through many revolutions to find the error for a low cost 2.5-digit DMM, while still providing the 5500A's full resolution and accuracy potential for calibrating a high end 6.5-digit benchtop model.

The remaining keys on the 5500A's front panel are for things like resetting the 5500A, setting it up for remote operation via the inbuilt RS-232C or IEEE-488 interfaces, getting it to perform an automatic self-zeroing, and selecting the mode of compensation for resistance calibration, etc.



Visible in this close up view are the dual output terminal pairs, recessed and shrouded for operator safety. Also visible at upper right are the STBY and OPR buttons, which again help to ensure operator safety.

Using it

Needless to say, while we had the sample 5500A in our clutches, it was used to either calibrate or check the calibration of almost every DMM, analog and audio test instrument in the *EA* lab — and also most of those from our own home workshops. So overall, we gave it quite a workout. It was too good an opportunity to miss, especially as the sample unit came complete with its own calibration certificate, showing exactly how it had checked out against an even more accurate calibrator only a few weeks previously!

Before using the 5500A to calibrate and check all of these instruments, I went through the procedure of getting it to perform its automatic self-zeroing. This ensured that we achieved its full potential. Needless to say we always allowed it to warm up for the recommended 30 minutes, at the start of each session, and for low resistance calibration we used either the two-wire or four-wire compensation configuration as appropriate to cancel out the effect of lead resistance.

And our summary, after using the 5500A fairly extensively for a little over a week? Frankly, it's an absolute pleasure to use. We hadn't anticipated that it would be so straightforward and convenient to calibrate or check the calibration of DMMs and other instruments, as Fluke have made this operation with the 5500A.

So if your organisation needs to have its own calibration facilities, and can justify the cost of a 5500A (the base price is around $20,000), it certainly has *our* vote of commendation. Philips T&M also has our grateful thanks for allowing us to try one out.

Further information on the 5500A and other Fluke calibrators is available from Philips Scientific and Industrial T&M Division, 34 Waterloo Road (PO Box 119), North Ryde 2113; phone (02) 888 8222, or fax (02) 888 0440. ❖

SPECTRUM

Communications News & Comment

Conducted by
Tom Moffat

Good news and bad news

Well, here we are again, so it looks like the Spectrum column has survived two months at least. This is a convenient state of affairs because I come bearing glad tidings. Well, it's a case of good news/bad news really; so we'll start with the good.

I have learned from a source within the Spectrum Management Authority that the long-awaited 'no-code' amateur radio licence should be a reality by the time you read this. This means you can now get on the air with a minimum of technical knowledge, and zero Morse code knowledge, and communicate to your heart's content.

It's expected that most users of this new licence will be electronics types who shunned amateur radio in favour of computers, because of the difficulty of learning Morse code. Many see the code as an anachronism, a relic of the distant past, which has no place in modern communications. So with the code no longer compulsory these computer hobbyists will become radio hobbyists as well, with the aim of interconnecting their computers over the air.

This is done now, of course, via packet radio. But with the influx of new blood packet radio is certain to explode in popularity. I suspect a lot of manufacturers of VHF amateur radio equipment are gearing up for the rush of new licensees. I've taken a punt and organized another big run of my Pocket Packet kits to interface the computers with the radios.

This new licence should be a real shot in the arm for amateur radio, which has certainly been stagnating lately. As the old saying goes, you ain't seen nothin' yet!

Now, as promised, the bad news. If you've been following the international currency situation, you'll know that the value of the Yen has been climbing steadily. And it seems there's nothing anyone, not even Japan, can do about it. The increasing Yen has made their exports all the harder to sell, and of course anyone who buys Japanese goods with non-Japanese currency will find the price of the goods going up and up and up.

It's not a matter of the Aussie dollar going down; we've held on pretty well against the US dollar, but the Yen has appreciated against both. And now we in Australia are feeling the direct impact — cars, electronic goods, cameras — anything from Japan is going up.

So, Japanese radio manufacturer Icom has issued a new price list for Australia, with an eight percent across-the-board increase for everything they sell here — from the fanciest radios down to the smallest connecting cable. Icom's Sales and Marketing Manager Bob Wiley points out that the Aussie dollar would buy 75 Yen at the start of this year; now our dollar buys only 60 Yen.

I work that out at a 20% fall, yet the Icom increase is 8%, what Bob Wiley says is a minimum amount 'at this stage'. That suggests there could be worse to come in the future.



Icom's IC-A22 aviation transceiver, which features a built in VOR receiver.

Just a sampling of new prices (including sales tax) for some of the more familiar Icom equipment: The popular M700 marine SSB transceiver comes in at $4428. The IC-781, Icom's top of the range amateur transceiver, is now $12,630. The R7100 VHF/UHF receiver/scanner is now $3387, and the R72A HF receiver is $2014. The R9000, the king of communications receivers, now goes for $11,288, compared with around $7000 when I reviewed one when it first came out.

Keep in mind that you can't blame any of this on the 'greed' of Icom, or any of the other manufacturers that are also slugging us with price rises. More buyer resistance will cause their businesses to be less profitable, but they have no choice in the matter. They, like all the rest of us, are at the mercy of the international currency markets.

New Icom gear

Along with the new price list, Icom sent us information on some of their new products. (Other manufacturers, we're waiting to hear from you too!)

We usually equate Icom with amateur gear, since that's what we see advertised so much in the electronics press. But many of Icom's products are aimed at more commercial markets, particular marine and aviation. And there seems to be an emphasis on hand-held products.

Yachties will be interested in the M15, a handheld marine VHF radio with 'waterproof' splashed across the top in bright red letters. There's always a danger of standing there in an open cockpit jabbering away on the radio when a big wave breaks across the bow. What you can do if you're brave (some free advice here) is immediately remove the battery and then put the drenched radio in a bucket of fresh water, to dilute the effects of the salt trying to eat it away. You may wreck the speaker, but that's better than wrecking the whole radio. The same treatment works for dunked cameras too. You can clean them out when you get home.

The M15 is housed in a strong aluminium case, with all kinds of fancy seals to make it waterproof to a depth of one meter for 30

minutes, according to the spec. I had invisaged taking one of these radios on a cruise in my seagoing kayak, to see what would happen when I got tipped out.

Luckily I checked with Icom first, to learn that the radio does not float, and an unplanned Eskimo roll would send it straight to the bottom. So the M15 will never need the bucket of water treatment. It will easily survive a dunking on deck, but if it goes overboard, blub-blub-blub and goodbye radio!

There are also a couple of aviation items that look especially interesting. One is a handheld airband transceiver (118-138.95MHz AM) that includes a VOR navigation receiver. For those not yet in the know, VOR (Voice Omni Range) is a popular navigation system in which a transmitter on the ground sends out a pair of signals, one of fixed phase and the other whirling around through 360° fifteen times a second. With a little simple electronics a VOR receiver can compare the phase of the two signals and deduce within a degree or so which direction the receiver lies in relation to the transmitter.

You can visualise this as kind of a compass rose, with radial lines extending out to a distance of 60 nautical miles or so. These imaginary lines are called 'radials' (wow!). An aircraft can latch onto one of the radials by dialling in the desired heading to or from the station. The pilot can then follow the radial by watching a needle display on an instrument in the cockpit, and keeping the needle centred.

The M15 handheld does not have the needle display; instead it appears to use a series of LCD arrows that point right or left as you deviate from the selected radial. So if you steer to get rid of all the arrows, your course is right on the button.

This snazzy NAV/COM unit would be right at home in something like an ultralight or gyrocopter or glider. These small aircraft usually don't carry permanent radio equipment, because there's not much room and usually no electric power. So the handheld is the way to go. It seems to be a pretty rugged little radio, but, as with the marine set above, you wouldn't want to drop it overboard.

In the same vein, Icom has a small airband mobile which would fit nicely into the sport aviation market, or small airport operations in general. The A200 is designed to fit in the standard mounting bracket used in most aircraft.

There's also an optional mounting cradle available to allow the radio to be slung under the dashboard of a plane or car; the case is very low-profile, so it should not compromise knee room too much. A third option is a case containing a 12V power supply and a speaker, and a slot on the front panel which exactly fits the A200.

So the radio can be used in an aircraft, or in a vehicle, or on a desk as a base station. It would be the ideal comms radio for a small country airport, or for operating out of the back of a station wagon at a glider club meeting. Icom says the radio is also being bought by the military, for use between ground and air during exercises such as target practice.

There are several more handhelds in Icom's collection, for the commercial VHF/UHF bands, for UHF-CB, and for amateur. The latest amateur handheld has a removable front panel which can be carried on the lapel like the cops on 'The Bill' do.

The latest amateur 'big rig' is the IC-706, a do-everything box for HF, six metres and two metres, all modes on all bands. The 706 is TINY; the photo in the brochure shows it sitting next to a cup and saucer, and the radio is about as wide as the saucer's diameter. Yet it still churns out 100W on all bands except two metres, where it does 10W.

Despite the fact that 'Morse code is dead', Icom has seen fit to include lots of CW features in the 706 — a full electronic keyer with variable weight, variable pitch, and even a CW-reverse mode to reduce interference from other stations. Who was it that said "Reports of my demise are premature..."?

It's interesting to note that not a lot of noise is being made nowadays about the 'mobile radio' of old, the Joe-the-plumber system of a base station at the garage workshop and two mobiles mounted under the dash of the trucks. In fact in Icom's price list there are now six traditional mobile radios against 22 portables for VHF/UHF.

I asked the SMA about this, and learned that a combination of cellular phones and CB radio have just about killed the small, privately owned radio network. Such systems are still being used a lot in the country where few alternatives exist, made up primarily of pre-owned gear rejected from the cities. Further erosion of this type of service is expected as a result of the recent horrendous increases in licence fees and the 'spectrum tax'.

In comparison, no licences at all are needed for CB, and mobile phones are getting cheaper and cheaper. The current going rate for a mobile phone in Hobart is $179 for an analog model, dirt cheap because analog is to be 'phased out'. But the SMA man said he would be very surprised indeed if the phase-out ever actually occurred; he expects extension after extension, past the official cutoff date. Interesting...

More from Drake

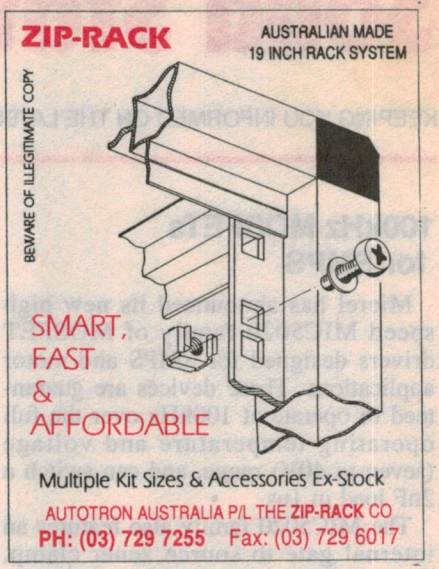
Now some news from Drake, which did not duck the opportunity to send us some guff on their latest pride and joy. You may have heard of a Drake receiver called the R8. This radio looked rather unpretentious and boasted good solid performance, rather than 'startling' performance. And it seems to have become one of the world's most respected shortwave radios, especially among the DX-chasing types who hang out on the Internet. There's been lots of chat about this set.

The R8 seemed a lot like Yaesu's FRG-8800 which I once owned; a no-nonsense receiver that tuned in a station, shortwave or otherwise, and then sat there and played beautiful music through a top-class audio stage. There were a couple of built-in clocks so you could record stuff in the middle of the night without getting up.

Drake has now introduced the R8A, which features things that were optional on the R8, such as a collection of five selectable filters. The A version also includes a built-in VHF converter (as did the FRG-8800), allowing reception from 35-55 and 108-174MHz. The 35-55 segment is the American low-band VHF allocation and there's not much action down there in Australia, although you'd probably hear stuff skipping through from the USA from time to time.

The R8A of course covers all modes, but I get the feeling it really shines on AM as used by international broadcasters. A synchronous detector is provided for best AM performance, and there's even a way to store an alpha-numeric description along with the frequency and mode in the memory channels. So you could have the display show 'RadAust' along with 6080kHz AM.

See you next month (information permitting...). ❖



READER INFO NO. 17

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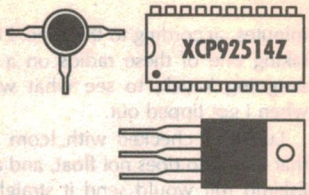
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READER INFO NO. 18

Solid State Update



KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

100kHz MOSFETs for SMPS

Micrel has announced its new high speed MIC5020 family of MOSFET drivers designed for SMPS and motor applications. These devices are guaranteed to operate at 100kHz over the full operating temperature and voltage (seven to 40V) range, and can switch a 2nF load in 1us.

The MIC5020 family also features an internal gate to source zener clamp, reduced EMI and a programmable overcurrent shutdown with adjustable reset time/soft start.

The MIC5022 high H-bridge driver also features an interlock which prevents any cross conduction between the high and low side switches.

The family includes the MIC5020 low side driver, the MIC5021 high side driver and the MIC5022 half H-bridge driver.

For further information circle 272 on the reader service coupon or contact GEC Electronics Divison, 38 South Street, Rydalmere 2116; phone (02) 638 1888.

Hall effect gear tooth sensors

Allegro MicroSystems has released a family of Hall effect gear tooth sensors which can be used in speed, position and timing applications and which operate down to zero speed over a wide range of air gaps and temperatures.

The A3046, A3056 and A3058 devices are monolithic integrated circuits which switch in response to differential magnetic fields created by ferrous targets. When combined with a back biasing magnet, they can be configured to give a 50% duty cycles, or to switch on the leading, trailing or both edges of a passing gear tooth or slot.

Each device has two orthogonal Hall effect elements, a voltage regulator, temperature compensating circuitry, low level amplifier, Schmitt trigger, and an open collector output driver.

The on-board regulator permits operation with supply voltages from 4.5V to 24V, and the output stage can switch up to 20mA at repetition rates to 20kHz. The output is compatible with bipolar and MOS logic circuitry.

The on-chip temperature compensation and Schmitt trigger circuitry minimise shifts in effective air gaps and switch points caused by changing temperature. As a result, the devices can be used for timing and speed sensing applications in hostile automotive or industrial environments.

The low hysteresis of the A3046 and A3056 makes them suited for use in anti-lock braking systems or in speed sensing applications where large air gaps are required. The high hysteresis of

High gain CATV amplifier

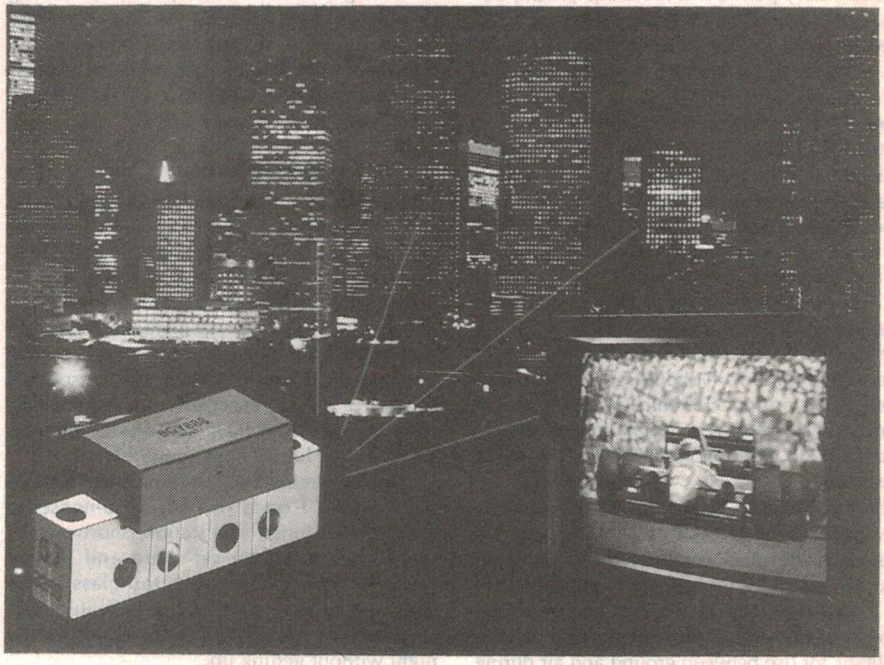
Providing 34dB of power gain in an SOT115 packaged module, the new BGY888 CATV amplifier module makes it possible to build 860MHz CATV line extenders containing only one active device. This thin film hybrid amplifier has two cascaded amplifier stages to achieve its exceptionally high gain and excellent linearity.

Low current consumption, an industry standard mechanical footprint and accurate 75 ohm input and output matching (which results in return loss specifications typically better than 14dB) make the amplifier suitable both for new networks, and for upgrading existing ones. Other applications include RF amplifiers for telecommunications systems and wide area computer networks.

The BGY888 has push-pull cascode stages, giving a frequency response within +/-0.5dB (worst case) over the device's 40MHz to 860MHz bandwidth. Operating from a 24V DC supply, it draws a maximum supply current of 340mA, claimed to be considerably less than that drawn by the two or more amplifier modules usually found in CATV line extenders. The result is a significant reduction in overall network power consumption.

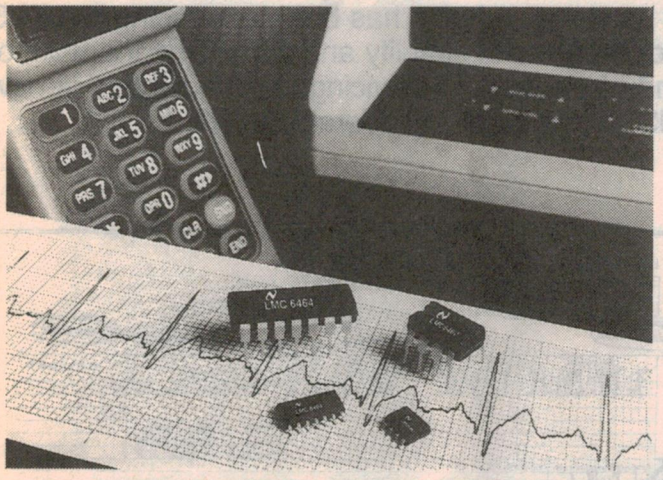
The module is housed in a rugged SOT115 package which is pin compatible with industry-standard 600MHz CATV amplifier modules.

For further information circle 271 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4479.



Micropower op-amps

National Semiconductor has introduced the LMC6462 (two channel) and LMC6464 (four channel) micropower, rail-to-rail and output op-amps designed for portable applications. These micropower op-amps deliver minimal power consumption (20uA per channel), precision DC offset (0.5mV max), high voltage gain (128dB) and rail-to-rail input and output. This combination of features is said to make the LMC6462 and LMC6464 ideal for signal conditioning and sensor applications in system designed for the mobile communications, laptop, portable instrumentation and handheld medical instrumentation markets.



Both devices feature a common mode range that extends beyond the supply rails and the rail-to-rail output swing is guaranteed for loads down to 25k ohms. The rail-to-rail input/output feature maximises both the signal to noise ration and the dynamic signal range, making the devices suitable as an interface with A/D converters.

The op-amps have a guaranteed performance at both 3V and 5V, making them ideal for battery powered systems. Requiring only a single power supply, both will operate from either a 3.3V regulated or unregulated power supply. Additional features include 100fA ultra-low input bias current, and a high CMRR (85dB).

The LMC6462 is available in either an eight pin DIP or SO version. The LMC6464 is available in 14-pin DIP and SO versions. All four packages are guaranteed across the industrial temperature range (-40°C to +85°C).

For further information circle 276 on the reader service coupon or contact National Semiconductor (Aust), 16 Business Park Drive, Notting Hill 3168; phone (03) 558 9999.

the A3058, together with its excellent temperature stability, makes it suited to ignition timing applications where switching point accuracy and latching capability are important. The devices are supplied in three pin plastic single inline packages.

For further information circle 273 on the reader service coupon or contact VSI Electronics, 6-8 Lyon Park Road, North Ryde 2113; phone (02) 878 1299.

SMD MOSFET rated for 240V

Offering both low on-resistance and a low threshold voltage, a new 240V MOSFET device type has been launched by Zetex. The ZVP4424G device is supplied in an SOT223 surface mount package.

At a gate source voltage of 3.5V, the MOSFET has a maximum on-resistance of 12 ohms for a drain current of 100mA. It also has a maximum $V_{DS(sat)}$ of 2.0V, which suits battery powered applications. Rated as a fast switching device, the medium power MOSFET has typical rise and fall times of 8.0 and 20ns respectively, for a current of 250mA, making it suitable for telephone recall, hook and dialling applications, and converter circuits.

The ZVP4424G can control a continuous drain current of 480mA and a maximum pulsed current to 1A. Maximum power dissipation is 2.5W for an ambient temperature of 25°C. Featuring a typical input capacitance of 100pF, the MOSFET has a wide gate source voltage rating of +/-40V.

The useful operating and storage temperature range for this device is -55° to 150°C. A comprehensive ZVP-4424G data sheet outlines full Spice model parameters for computer simulation and test.

For further information circle 273 on the reader service coupon or contact VSI Electronics, 6-8 Lyon Park Road, North Ryde 2113; phone (02) 878 1299.

Transistor suits electronic ballasts

Offering high speed, high voltage switching capabilities in a plastic power package, the BU1706A silicon diffused NPN power transistor is claimed to be a practical, low cost alternative to power MOSFETs in electronic lighting ballasts.

Its peak collector emitter voltage (VCESM) rating of 1750V and low switching losses also allow this transistor to be used in applications where power MOSFETs are prone to breakdown — for example, in fluorescent lighting systems which operate from AC supplies approaching 300V.

Fall times as short as 0.2us with indictive loads and low overall switching losses allow the transistor to operate with little or no heatsinking in high frequency ballast circuits, while a maximum collector emitter saturation voltage (V_{CESAT}) of 1.0V at 1.5A minimises DC power dissipation.

The device has a typical DC current gain (h_{FE}) of seven at collector currents of around 6A. Its maximum continuous DC and peak collector current ratings are 5A and 8A respectively. Typical h_{FE} at a collector of 400mA is 18.

The transistor is available in a T0220 plastic power package or a fully isolated SOT186A plastic package (designated the BU1706AX).

For further information circle 277 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4479.

❖

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UNDERSTANDING THE IRIS CODES

For the last couple of years, Europe's electronics servicing industry has been embracing the IRIS fault/repair coding system — devised by Sony, and designed to simplify and streamline the work of tracking, charging and claiming for almost any kind of electronics servicing. As the system is now coming into use in Australia, this introduction to IRIS should be of considerable interest.

by DAVID BOTTO

IRIS has quietly arrived in Australia. Easy to learn, IRIS saves the serviceman much work, tension and frustration. Mountains of tedious paper work just disappear, and the day-to-day running of the service workshop is simplified.

Not so long ago, it was necessary for the serviceman to laboriously type or write out Mr Brown's repair bill, wasting valuable time searching for the correct words and terms. He can now use the IRIS code stored within his PC workshop computer program. After tapping in a few numbers and codes, the 'print' key is pressed and the printer ejects a fully detailed and priced bill. IRIS does most of the translation work for him.

Sony defines the IRIS code, which it devised in 1986, as a means of translating the customer-stated fault, the serviceman's description of that fault and the repair undertaken, into a series of coded digits. These digits, in conjunction with a good PC workshop management program, can help the engineer by standardisation of the terms and phrases used.

Installing a workshop program that contains the IRIS code on your PC is a sound investment. Make sure that you purchase the latest version, to ensure that the IRIS codes are fully updated. (See box 'Workshop programs that use IRIS Codes'.)

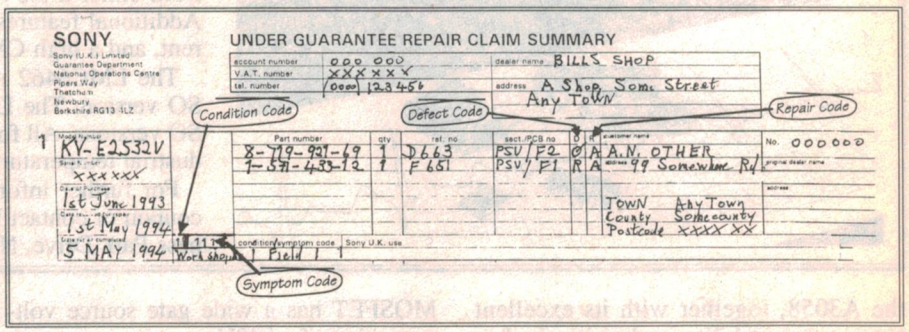


Fig.1:The Sony guarantee repair claim summary form automatically enters details such as name, address, phone number and Sony account number.

One advantage of IRIS coding is that it enables the service engineer to make claims on a manufacturer's guarantee easily, simply and accurately. The standard format, description of the fault and repair details can be printed out on the job history or invoice.

When Sony receives a claims report the IRIS code pinpoints recurrent failures and stock faults. The main benefit to Sony is that the information they receive is in a standard format — a vital requirement for electronic data information transfer of claims.

The code originated in Japan, but has been used successfully in Europe for several years. For Sony it proved to be the ideal system for conveying repair data throughout the company. Sony revised and expanded the IRIS code in 1989, to provide the more detailed information re-

Table A: IRIS Condition Codes

1	Constantly	Symptom is always present, under any condition
2	Intermittently	Symptom appears and disappears at irregular or irregular intervals
3	After a time	No symptom at switch on. Appears a certain time after set activated
4	Hot environment	Symptom appears under high ambient temperatures, but within normal specified operating temperatures
5	Cold environment	Symptom appears under low ambient temperatures, but within normal specified operating temperatures
6	When switching	Symptom appears when user activates a function of the set
7	Under vibration	Symptom occurs when set is subjected to mechanical shocks or vibration
8	Wet environment	Symptom appears when relative air humidity is very high, but within the specified conditions of normal operation
9	Dry environment	Symptom appears when relative air humidity is very low, but within specified conditions
A	Dropped	Symptom appeared after being subjected to a heavy shock
B	After lightning strike	Set was damaged by a lightning strike
C	Only certain stations(s)/ software/mode	Symptom appears only when tuned to certain channels or frequencies, or when playing or recording specific software. Or when using a specific operating mode, e.g. Edit mode, digital effect on, etc.
D	Only on certain	In a multi-standard set, symptom appears only when using a specific standard. (e.g., only PAL-Mode, etc.)
E	Only on one channel	Symptom appears only on one channel channel of a stereo pair
F	Only with certain input(s)	Symptom appears on one (or more) of certain input(s) a series of different inputs
G	Only with certain output(s)	Symptom appears only on one (or more) of a series of different outputs
H	In standby/off mode	Symptom appears only when set is switched off, or in standby mode
J	At edit point	Symptom appears at point where an edit is or has been carried out
K	When interconnected	Symptom appears only when set is connected to another piece of equipment
L	Liquid contamination	Set was submerged in a liquid, or a liquid infiltrated the unit, causing the problem
X	No symptom/problem found	Even after a complete investigation, technician could not confirm the claimed symptom
110	Power problem	
111	No power on AC	That is, when connected directly to the mains supply

Table B: IRIS Symptom Codes (Main headings only shown)

110	Power Problem
120	Charging Problem
130	Display function problem
140	Abnormal noise
150	Remote control problem
160	Physical damage
170	General function problem
180	Special requirements
210	No reception
220	Poor reception
230	Transmission problem
240	Noisy reception
250	Unstable reception/transmission
260	Tuning problem
270	Special communication problem
280	Special reception problem
310	No picture
320	Picture level problem
330	Picture quality problem
340	Picture noise
350	Unstable picture
360	Poor picture recording
370	Special picture function problem
380	Picture display/pickup problem
410	No colour
420	Colour level problem
430	Poor colour quality
440	Noisy colour
450	Unstable colour
460	Poor colour recording
470	Special colour picture function problem
510	No audio
520	Audio level problem
530	Audio quality problem
540	Noisy audio
550	Unstable audio
560	Poor audio recording
570	Poor special audio function
580	Stereo/Multi mode operation problem
610	No mechanical operation
620	Irregular mechanical operation
630	Speed problem
640	Mechanical noise
660	Damage to software
670	Mechanical operation problem
680	Lens problem
710	No data processing operation
720	Faulty data processing operation
730	Data display problem
760	Data read/write problem
770	Special data function problem
810	No printer operation
820	Faulty printer operation
830	Poor print quality
840	Noisy printing
850	Unstable printer operation
860	Ribbon/paper problems
880	Faulty font/character functions

quired by the latest technology. IRIS can now be used worldwide.

IRIS is an acronym for Integrated Repair Information System. It has been accepted as the industry standard repair code for Europe, and is now used by most European electronics and TV manufacturers.

How IRIS works

IRIS consists of letter and number codes. Each code represents information that might otherwise be lengthy to type or write out in full, and possibly difficult to describe accurately. Fault data is conveyed precisely, without ambiguity. Large amounts of information can be recorded and recalled easily. The IRIS codes are: condition codes, symptom codes, section codes, repair codes, defect codes, and rejected claim reasons. Part numbers, reference numbers and section PCB numbers form an important part of the IRIS code.

Tables A to F list the basic codes. Please carefully study these listings. To make things clear, we'll give some examples of their use.

Condition Codes: It is important to be aware that the condition and the symptom codes on the Sony Guarantee claim form are the customer's perception of the stated fault, not the service engineer's findings. The coding can accommodate the service engineer's condition and symptom for each part number entered, but this is optional.

The condition code (Table A) is the first one entered on the job sheet or the manufacturer's claim form. Fig.1, for example, indicates that the symptom is always present under any condition. If a TV set had permanent sound failure, you'd enter 1. If the sound went on and off intermittently, 2 would be entered. A set that's completely and permanently dead gets a 1 entry.

A dropped TV is coded A. L stands for liquid contamination. If the customer spills beer or lemonade into a VCR — a cause of failure that the long suffering serviceman regularly encounters — then the correct code to enter is L.

Note that not all codes are valid for guarantee claims; liquid spillage (L) is not. If no fault can be found with the equipment, the code entered is X.

Symptom Codes: Next the symptom code is entered. (Table B). Here the code is chosen that accurately describes the problem as it can be observed with the five senses. It's important that the symptom code be entered before making any technical checks or measurements on the equipment.

Table B is a shortened listing, showing only the main headings. The full code list subdivides each symptom into more specific conditions. For example entering 110 specifies a power problem while entering 111 indicates that there is no power on AC, i.e., when the equipment is connected directly to the mains supply. 430 means poor colour quality. 431 means some or all colours missing.

We haven't the space here to include the full list. A full copy of the IRIS code is issued with each Sony warranty pad. A free copy can be obtained from Sony Australia Ltd., PO Box 377, 33-39 Talavera Road, North Ryde, NSW 2113, telephone (02) 887 6666 (or from Sony (UK) Ltd, Warranty Department, National Operations Centre, Pipers Way, Thatcham, Newbury, Berkshire RG13 4LZ, England).

Workshop programs that use IRIS codes

Here are some typical servicing workshop programs that incorporate the IRIS code, and their UK suppliers:

F4
xBASE Computing, 19 Great George Street, Bristol BS1 5QT, England. Telephone 0272 290 846.

ServiceBase
PC Control Systems Ltd, Hamilton House, 66 Palmerston Road, Northampton NN1 5EX, England. Telephone 0604 601 677. (Australian version available)

Workshop Manager Plus
Wessex Microtech, 3 Ladymead, Ilminster, Somerset England. Telephone 0460 55 166.

Table C: Section Codes

ANT	Antenna section
APR	Signal processing
ARM	Arm mechanism
BCH	Battery charge
CHA	Chassis
CLK	Clock/timer section
CTR	Control Panel
DOM	Disk drive mechanism
DFL	Deflection circuit
DPR	Signal processing (digital)
EXC	External connector
FDD	Floppy Disk drive
FLX	Flexible PCB
FMW	Firmware
HCM	Head carriage mechanism
HDD	Hard disk drive
HFS	High-frequency section
HOL	Cassette holder
IMG	Image display unit
INC	Internal connector
INP	Signal input section
KBO	Keyboard
LDG	Loading mechanism
LNM	Lens mechanism
OUT	Signal output section
MEM	Memory circuit
PDS	Control panel display section
PIN	Pinch roller/lever
PRG	Programming section
MIC	Microphone section
PFM	Paper feed mechanism
PRI	Print block
PSU	Power supply
PUD	Pick-up device
REM	Remote control section
RFM	Ribbon feed mechanism
RFU	Booster/RF unit
RHD	Rotary heads
SFT	Software (tape, disk, etc.)
SHD	Stationary heads
SLD	Sled mechanism
SNS	Sensor unit
SPK	Speaker
SRS	Supply reel section
STA	Static block
SVO	Servo section
SYS	System control section
TDM	Tape drive mechanism
THR	Threading mechanism
TNR	Tension regulator
TPT	Tape path
TRS	Take-up reel section
TIM	Timer section
TUN	Tuning section
TXT	Text processing
VWF	Viewfinder
WIR	Lead wire
XXX	Cabinet/cosmetic parts

THE IRIS CODES

Section Codes: The section codes, Table C, pinpoint the area or section of the equipment in which the fault lies. For example, if the clock/timer section of a VCR is faulty, then the section code to be entered is CLK. If the cassette loading mechanism is defective, then the code is LGD. Other examples are TUN for a fault in the tuner section, HDD for a PC with a faulty hard disk drive mechanism, VWF for a camcorder viewfinder fault, and SPK for a faulty loudspeaker.

Repair Codes: These are listed in Table D. When parts are replaced the Repair code is A. Resolder a dry joint, and the code is D. Code F indicates that all or part of a mechanism has been lubricated. If the equipment is returned without a repair having been carried out, the code is Y. A repair estimate that has been refused is coded V.

Not all of these repair codes are valid for under guarantee claims: to make things easier for the serviceman, the Sony warranty pad omits all non-valid codes.

Defect Codes and Rejected Claims: For these see Table E. They are divided into two sections: mechanical and electrical. If a mechanical part has worn out, the code is A. If it has snapped off, the code is F. Lack of lubrication is code L. An electrical short-circuit is code Q. A cracked PCB board is code V, a missing component is Z, while defect code 1 indicates a PC program software bug.

Table F shows the codes used to specify why a claim under the guarantee has been rejected. For example, if a set has been dropped on a concrete floor the code would not be valid for warranty purposes. O/W indicates that the set is out of its guarantee period, while DOP means that the date of purchase needs to be checked.

Reference and Part numbers: Component circuit reference and part numbers are important pieces of information that must be entered. Obtain them from the service manual.

Guarantee claims

Fig.1 shows the Sony guarantee repair claim summary form. Most workshop PC programs will display and print the under-guarantee claims forms used by Sony and other manufacturers. These programs automatically enter details such as your name, address, telephone number and your Sony account number. The appropriate IRIS symbols are inserted in the various boxes.

Suppose you repair a Sony KV-E2532U TV under manufacturer's guarantee. The customer says that the fault is 'dead set'. Tests show that the main bridge rectifier on the F2 board has an internal short circuit. Fuse F651 on the F1 board has blown. On replacing these parts, the serviceman finds to his relief that normal operation is restored.

Having entered the details in the top and left-hand side panels of the claim form (Fig.1) we now enter the IRIS symbols. Check the codes in Table A. Since the customer's stated fault was a constantly dead set, we enter a 1 in the condition code box. When connected to the AC mains no power reached the circuitry, so right next to the condition code we enter the symptom code 111. (See Table B).

The part number of the bridge rectifier is 8-719-510-63 and the reference number is D663. These codes are found in the Sony service manual. Now the section code is entered. Since bridge rectifier D663 is in the power supply, the code PSU is entered. The PCB number shown in the service manual is F2.

Next on the claims form, we come to the letters D and R. D stands for Defect code and R for repair code. Bridge rectifier D663 had shorted, so the defect code Q is entered (Table D). D663 was replaced by a new component so an A is entered on the form (see Table C) under R (repair code).

The blown fuse, reference number F651, is located on PCB F1 — part number 1-576-232-21. This PCB is also in the power supply section, so the code PSU is entered. The fuse was open-circuit, so R is entered as the defect code under D. The fuse was replaced, so A is entered as the repair code under R.

When Sony receives the claim they will at once know all the necessary details of the repair. Similar entries are found on other manufacturers' claim forms.

Table D: Repair Codes

A	Replacement
B	Mechanical alignment
C	Electrical alignment
D	Resoldering
E	Cleaning
F	Lubrication
G	Repaired electrical parts
I	S/B modification
J	Removed components
K	Added components
L	Function check
M	Specification measurement
N	Maintenance
O	Refurbishing
U	Explanation added
V	Estimation refused
W	Estimation with parts
X	Estimation without parts
Y	Return without repair

Table E: Defect Codes

MECHANICAL	
A	Worn out
B	Dirty, clogged
C	Misaligned
D	Cut, broken
E	Deformed
F	Snapped
G	Scratched
H	Cracked, peeled, corroded
I	Loose
J	Shaky, unstable
K	Leaking
L	Dry (No lubricant)
M	Foreign object
ELECTRICAL	
N	Exhausted, low emission
O	Burnt, arcing, missing pixels
P	Misaligned
Q	Short
R	Open
S	Leaking
T	Bad contact, connection
U	Open pattern
V	Cracked PCB
W	Cold or no soldering
X	Bridged soldering
Y	Wrong component
Z	Missing component
1	Software bug

Table F: Rejected claim reason codes

C	Require customer name and address
DOP	Check date of purchase
F	Fault symptom required
M	Model number incorrect
N/C	Not eligible for claimback — i.e. cleaning etc.
OM	Old model — customer's sales receipt or delivery note to dealer required
O/W	Out of warranty
P	Part number required or incorrect
S	Serial number
MI	Missing/incomplete information

Customer bills

If the repair is chargeable to the customer, enter into your PC workshop program the IRIS codes and other necessary details. Your PC then computes and prints out the bill.

Conclusion

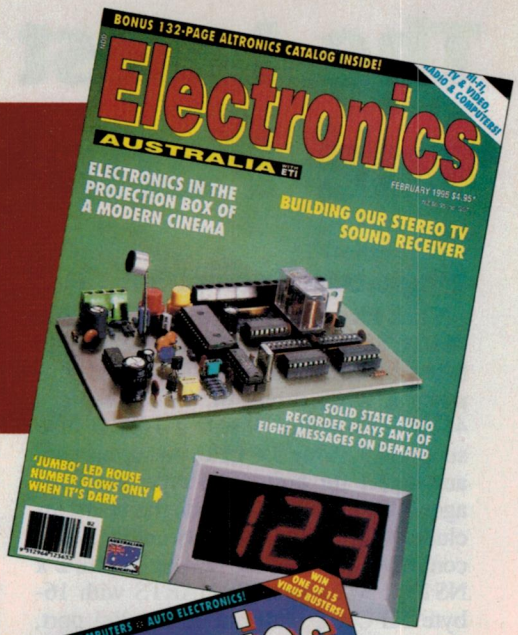
An important way in which the IRIS code benefits both Sony and its dealer is through Product Quality Feedback to the factories. Fault information helps Sony factories to turn out equipment that is as free from defects as possible, and to list and cure 'stock' faults. The IRIS coded data can be interpreted to analyse accurately the facts behind the basic figures.

To cope successfully with modern technology, the serviceman regularly has to learn new things. IRIS is one such thing he needs to know. Fortunately, the codes are easily understood. They have proved to be a valuable addition to the serviceman's skills.

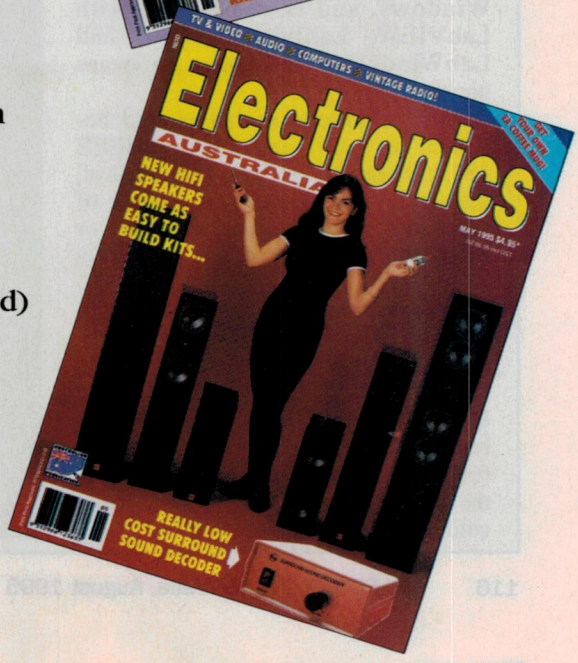
In closing, the author would like to thank Steve Deighton, Service Marketing manager, Sony (U.K.) Limited, for providing much information about IRIS and for permission to reproduce the Sony Guarantee form. ❖

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Single board computer

Click Electronics has released the SSC-486SCSI, a high performance, single board ISA bus computer. The board supports a wide range of CPUs, from a 486SX-33 to the 486DX4-100. It also supports 3.3V or 5V CPU operation with autodetect for both CPU type and voltage. Functions integrated on the board include VESA local bus true colour VGA controller, PS/2 mouse port on-board, 2 x NS16C550 compatible UARTS with 16-byte FIFOs, a multi-mode parallel port, fast SCSI-2 interface supporting up to seven devices, IDE hard disk controller that supports two hard disk drives and a floppy disk controller that supports two floppy disk drives.

The board is equipped with a ZIF socket for the CPU, and can accept up to 64MB of RAM, and up to 1MB of secondary cache.

For further information circle 211 on the reader service coupon or contact Click Electronics, PO Box 25, Bangor 2234; phone (02) 541 1006.

Fax/modem cards

The newly released NetComm InModem range of cards for PC to PC and fax communications is for internal use in IBM compatible PCs (ISA/EISA bus). All InModems are direct dial, full duplex, fully automatic intelligent modems that come with Windows data communications and fax software.

The InModems 144 and 288 incorporate high speed uncorrupted data and fax transmissions with the inclusion of MNP 2-4 and V.42 error correction protocols. Other features include fully automatic dial, answer, line speed detection as well as local and remote testing facilities.

The InModem 288 can transfer data at up to 28,800b/s, which enables significant time and therefore cost savings on large file transfers. All NetComm InModems feature fax operations that turn a PC into a full speed (up to 14,400b/s) Group III fax machine.

The RRP of the InModem 144 is $349, and $599 for the InModem 288 (including tax). For further information circle

Plug and Play IEEE 488.2 controller

National Instruments has released a Plug and Play ISA version of its high performance IEEE 488.2 controller board.

The AT-GPIB/TNT (PnP), which is completely software configurable, is compatible with both plug and play and non-plug and play computer systems.

The card includes the company's NI-488.2 driver software for DOS and Windows, and is compatible with LabVIEW, LabWindows/CVI, and LabWindows application software packages.

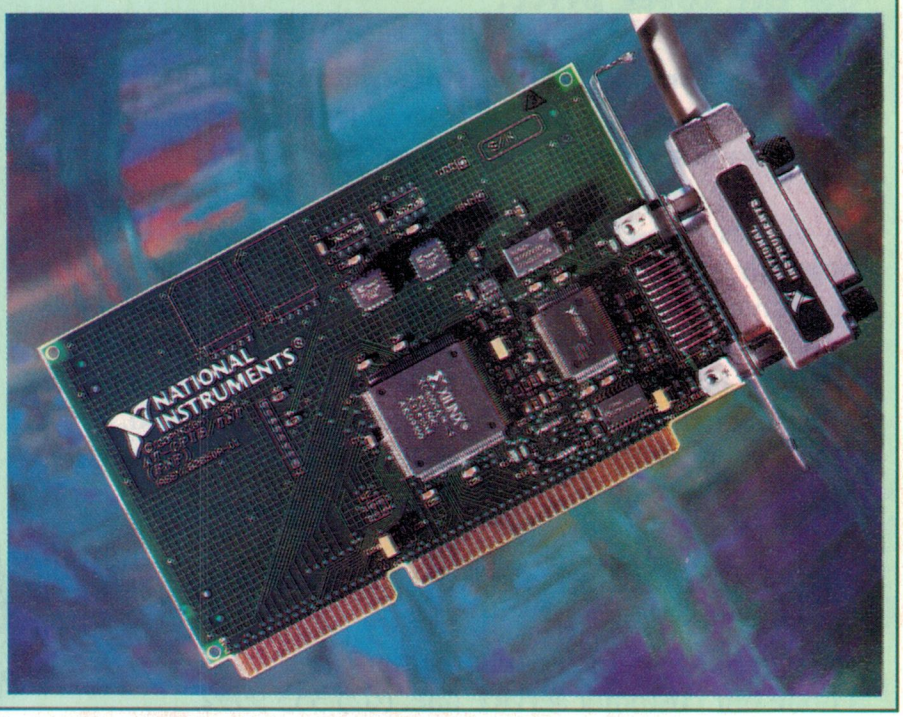
A PC equipped with the card becomes a high performance IEEE 488.2 controller to monitor, control, and communicate with thousands of GPIB-based engineering, scientific or medical instruments, and graphics equipment.

The card performs the basic talker, listener, and controller functions required by all versions of the IEEE 488 (GPIB) standards, and implements HS488 high speed data transfers for both read and write operations. In a fully compatible plug and play system, the hardware settings are automatically configured on power up.

For non-plug and play systems, hardware configuration is accomplished through the NI-488.2 configuration utility.

The NI-488.2 software for both DOS and Windows includes a full set of development utilities, including a GPIB monitor, an interactive debugger, configuration utility, and a suite of sample programs.

For further information circle 214 on the reader service coupon or contact National Instruments, PO Box 466, Ringwood 3134; phone (03) 879 9422.



PC/104 development platform

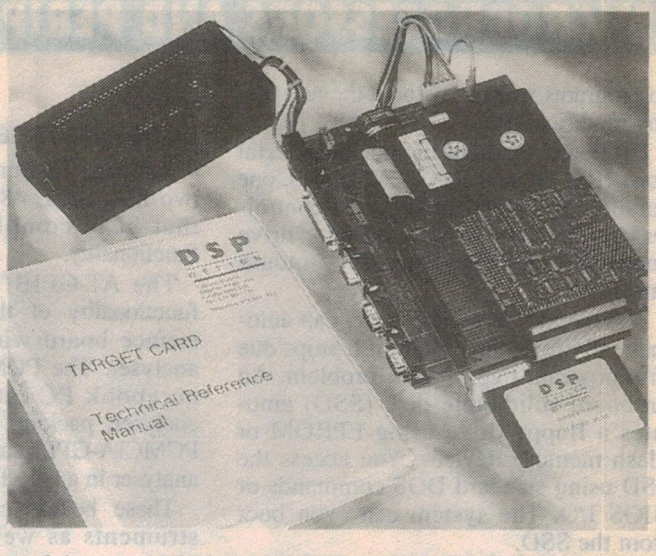
UK based DSP Design has released a PC/104 development platform. The TCPAK is a development system for industry standard PC/104 boards. When a processor board is plugged in and a PC screen and keyboard attached, the TCPAK becomes both a host PC to run a compiler/debugger and the actual target hardware to test and debug the code. There is therefore no need for a host PC, serial link or cable assemblies.

The TCPAK is claimed to reduce development time, reduce the amount of support calls and reduce the time to market. It consists of a development platform, power supply, cables, manuals and software utilities.

The development platform has a socket to accept PC/104 boards, and a full complement of standard PC port connectors: screen, keyboard, mouse, VGA, hard and floppy disk, COM1, COM2 and printer. DSP Designs' PC/104 processor boards (TC386/TC486) and all the boards in the family (digital and analog I/O, video, PCMCIA) simply plug into each other, and then into the development platform itself. One industry standard ISO 16-bit bus (AT bus) card can also be plugged in.

With the addition of a compiler and industry monitor debugger, the TCPAK system is a complete prototyping platform on which the code is generated and debugged within the target hardware environment.

The system can also be used as a convenient production test module — each board can be slotted in and out and tested in minutes. With a permanently mounted processor card, it also becomes a powerful PC in its own right. The DSP software utilities enable the user to create RAM/ROM solid state disks and includes many other useful utilities.



For further information circle 212 on the reader service coupon or contact DGE Systems, 103 Broadmeadow Road, Broadmeadow 2292; phone (049) 61 3311.

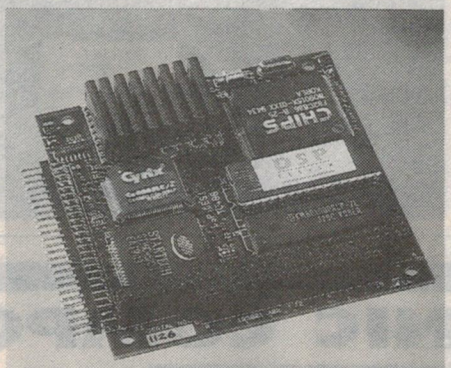
202 on the reader service coupon or contact NetComm, PO Box 379, North Ryde 2113; phone (02) 888 5533.

PC/104 PC compatibles

DSP Design of London, UK has released a new range of processor and I/O boards compliant with the PC/104 V2.2 specification.

The TB8680 integrates a 14.3MHz F8680 CPU, VGA graphics, three serial ports (RS232 and RS485), bidirectional parallel port, 10 bit A/D converter and DRAM/SRAM/Flash memory options on the one PC/104 footprint board.

For higher performance, the TC386 and TC486 are fitted with 25MHz 80386SX and 25MHz 80486SLC processors respectively. The boards support up to 4M of DRAM and feature standard PC compatible serial ports, parallel port, keyboard interface, PS/2 mouse port and speaker controllers.



For further information circle 203 on the reader service coupon or contact DGE Systems, 103 Broadmeadow Road, Broadmeadow 2292; phone (049) 613 311.

86 SBC with VGA, Ethernet

Priority Electronics has released the PCM-4860, an all-in-one single board 486 computer with an on-board Ethernet interface and VGA CRT/flat panel controller.

The PCM-4860 offers all the functions of an AT compatible industrial computer on a single board, but it fits in the space of a 5-1/4" floppy drive (just 5.75" x 8").

The board is 100% PC/AT compatible,



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so programs will run without the need for any modifications.

On-board features include two serial ports (RS-232 and RS-232/422/485), one parallel port, an IDE hard drive controller (for up to two drives), a floppy drive controller and a keyboard/PS/2 mouse interface.

The board's watchdog timer can automatically reset the system if it stops due to a program bug or EMI problem. An on-board solid state disk (SSD) emulates a floppy drive using EPROM or Flash memory devices. You access the SSD using standard DOS commands or BIOS I/O. The system can even boot from the SSD.

Disk capacity is up to 1.44MB, depending on the size of the memory chips. If you use Flash memory, you can read and write to the disk just like a floppy. If you use EPROM, the disk is read only and you must program the chips with an EPROM programmer.

All display and Ethernet configuration is done through software. A single Flash chip holds the system BIOS, VGA BIOS and the network boot ROM image. This method minimises the number of chips and eases configuration.

You can change the display BIOS or install a boot ROM simply by programming the Flash chip.

For further information circle 201 on the reader service card or contact Priority Electronics, 323-25 Melrose Street, Sandringham 3191; phone (03) 521 0266 or fax (03) 521 0356.

GPIB controller/analyser

National Instruments has announced two new IEEE 488.2 (GPIB) interfaces that have complete GPIB analyser functionality.

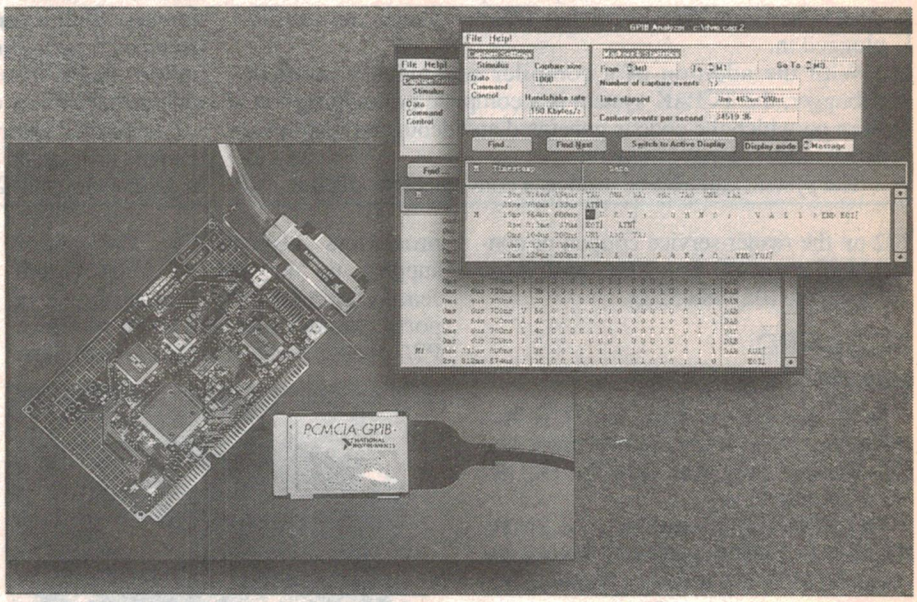
The AT-GPIB/TNT+ combines the functionality of the AT-GPIB/TNT interface board with a complete GPIB analyser. The PCMCIA-GPIB+ turns a notebook PC into a portable GPIB analyser, packing the functionality of a PCMCIA-GPIB card and complete GPIB analyser in a type II PCMCIA card.

These boards can control GPIB instruments as well as troubleshoot a variety of IEEE 488 hardware and software problems.

The cards alleviate difficulties associated with GPIB communication, such as addressing inconsistencies, protocol violations, bus time-out conditions due to termination characters, END transmission, and handshake holdoffs.

They are also the first GPIB analysers to monitor and capture HS488 activity, the company's patended high speed GPIB mode of operation.

For further information circle 204 on the reader service coupon or contact National Instruments, PO Box 466, Ringwood 3134; phone (03) 879 9422, fax (03) 879 9179. ❖



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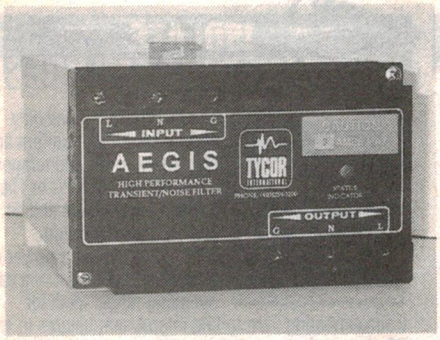
NEW PRODUCTS

Industrial AC powerline filter

Aegis is a series TVSS filter designed for PLC and other critical loads up to 15 amps. The unit provides protection against transients, surges and noise with a resulting reduction in component damage, errors and operating malfunctions.

The new filter is designed in accordance with ANSI/IEEE C62.41 (1991). It protects against all ringwave and impulse disturbances, and is housed in a DIN rail mountable enclosure. Ratings are 3, 5, 10 and 15 amp capacity. Optional flange mount housing is available. The filter can also be supplied for a two wire ungrounded system. The hybrid design provides protection against high and low energy transients, and noise. Being a tracking filter it reacts instantly to changes in frequency and voltage, regardless of phase angle, magnitude or polarity.

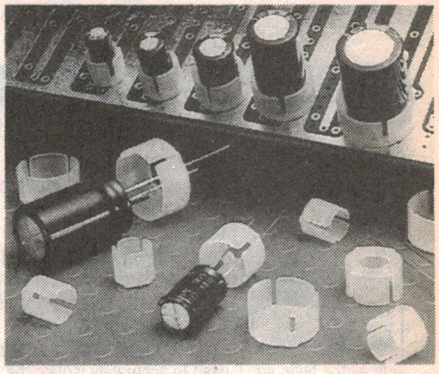
For further information circle 241 on the reader service coupon or contact Electromark, PO Box 134, Mortdale 2223; phone (02) 533 3322.



Electrolytic capacitor mounts

A new family of permanent mounts for electrolytic capacitors, which provide protection and enable proper cleaning during board assembly, is now available. The mounts feature a novel design which insulates and isolates the capacitors when used in high denisty applications, as in power supplies.

The ECM series comes in five standard sizes which accommodate the most popular sized electrolytics. Each mount features a slotted cup style, designed to provide supporting side walls that protect



and insulate the capacitor from surrounding components and circuitry, while allowing venting and proper drainage of fluids or contaminants caused during board assembly and washing processes.

Made from UL rated 94V-2 nylon per ASTM D4066 PA111, each mount raises the capacitor 1.3mm above the board surface. Moulded feet allow air circulation beneath the device, and ensure the proper removal of residues.

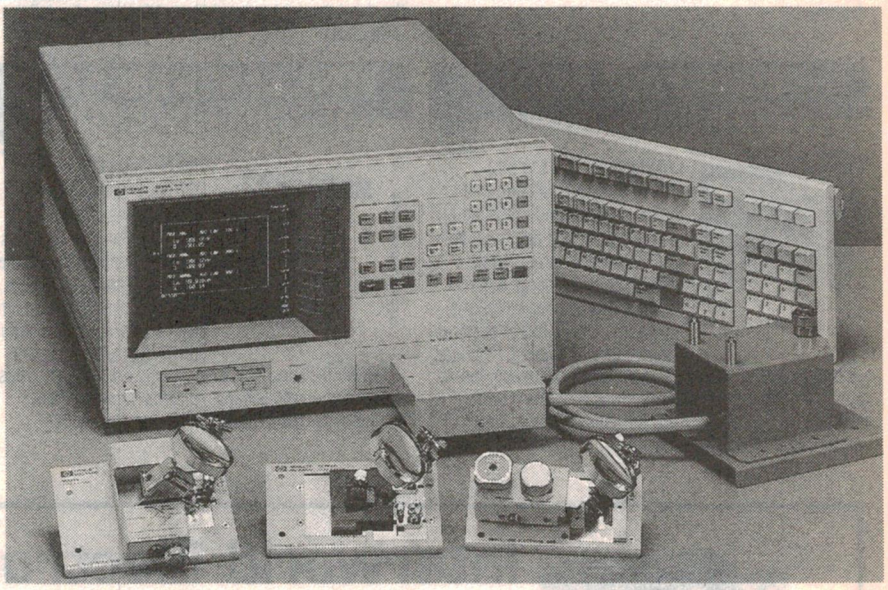
The mounts also make inspection easier and protect devices from shock, vibration and accidental lead bending during assembly.

1GHz LCR meter

Hewlett-Packard has announced the HP 4286A, claimed to be the world's first radio frequency LCR meter with a frequency range of 1GHz. An RF LCR meter is an instrument that measures inductance, capacitance and resistance. This meter applies a new measurement technique to test components at their actual operating conditions, allowing circuit designers to select the right components for their designs.

Most components are characterised under certain conditions by component manufacturers, but react quite differently under design conditions.

Componets are also getting smaller in size and in values, such as 1nH for inductors and 1pF for capacitors. These small value components are very difficult to measure accurately. The RF LCR meter uses a measurement technique called RF-IV to measure RF components accurately. This technique measures the complex current and voltage drop across a component to determine its impedance.



Specifications for the HP 4286A RF LCR meter from Hewlett-Packard, include a frequency range of 1MHz to 1GHz with 10kHz resolution, a measurement impedance range of 200m (ohm) to 3k (ohm) (10% accuracy area), a basic accuracy of 1% for impedance, a test signal of 10mV to 1V and a measurement speed of 15ns. The RRP of the instrument is $39,300.

For further information phone Hewlett-Packard's Customer Information Centre on 13 1347 (Australia wide).

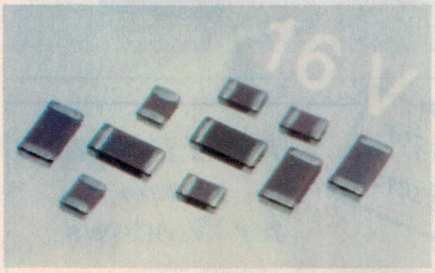
For further information circle 244 on the reader service coupon or contact M.Rutty & Co., 1/38 Leighton Place, Hornsby 2077; phone (02) 476 4066.

16V SMT multilayer capacitors

The new X7R 16V surface mount ceramic multi-layer capacitors from Philips have a greatly increased capacitance per unit volume compared with the 63V and 25V devices. They therefore allow much higher capacitances to be squeezed into the same case size.

The capacitors are supplied in three standard sizes. The 0603 range is from 22nF to 47nF; the 0805 range from 47nF to 220nF; and the 1206 range from 220nF to 680nF. The total range is available in E12 values with tolerances of +/-20%, +/-10% and +/-5%. The small size, performance characteristics and high reliability, make the capacitors suited to a wide range of applications where space and weight are limited.

The capacitors normally come with NiSn terminators suitable for reflow or wave soldering, but AgPd can



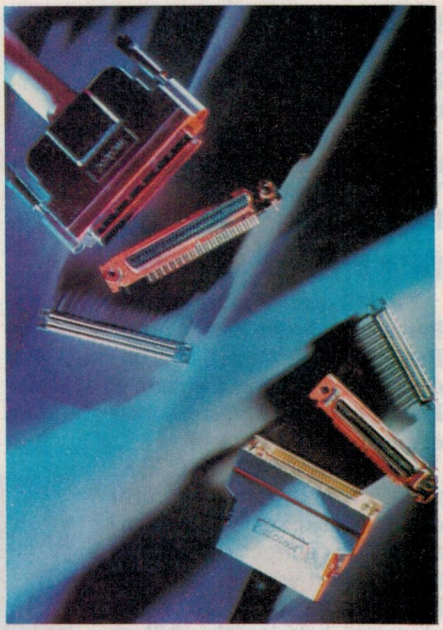
also be specified. They are supplied in tape on reel or in Philips' new bulk case packaging.

For further information circle 245 or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4479.

High density SCSI connectors

A new high density, shielded I/O connector line from Molex provides a mechanical interface in full conformance to the requirements of ANSI X3T10 group's SCSI-2 and SCSI-3 (SPI). Applications include mainframes, file servers, workstations, disk and tape drives, RAID (redundant arrays of inexpensive disks), CD-ROMs and personal computers.

The Molex SCSI+ product line includes a shielded plug, shielded overmoulding plug, shielded right angle receptables with and without latches, zinc die-cast strain relief kits, vertical



plastic receptable, 0.63mm ribbon cable male plug and applications tooling and hardware.

The receptacles consist of female tuning fork contacts and right angle or straight PCB solder tails, for boards 1.58mm to 3.18mm thick. The shielded right angle version is available with latch posts or screwlocks. An unshielded vertical version is also available. All interface dimensions conform to ANSI SCSI and IEC-48B (SEC) 199 specifications. Right angle receptacles have PCB hold down clips for board thicknesses of 1.58mm, 2.36mm and 3.18mm.

For further information circle 242 on the reader service coupon or contact Utilux, PO Box 68, Kingsgrove 2208; phone (02) 50 0155.

Enclosures from PacTec

Two new Pactec enclosures are ideal for meters, test equipment and other hand-held instruments. They feature ergonomics for handheld use, provisions for a 9V power source, waterproof 'O' ring gasket, and increased height for test lead jack. NEMA 4X rating is available in the gasketed version.

Features of the enclosures include insert tooling areas, flame retardant materials, connector cutouts, standard and custom membrane switches, custom panels and overlays, soft rubber protective holster, battery compartment, EMI/RFI shielding and LCD adaptors/bezels.

For further information circle 243 on the reader service coupon or contact RAE Industrial Electronics, 62 Moore Street, Austinmer 2515; phone (02) 232 6933 or (042) 67 3722.

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READER INFO NO. 23

NEW PRODUCTS

Cellular antenna tester

Bird Electronic Corporation has released the new AT-800 antenna tester. The tester covers 806 to 960MHz, making it suitable for the analog AMPS cellular system of Telecom and Optus, plus the three GSM networks of Telecom, Optus and Vodafone. The handheld tester is supplied in a compact and rugged case for field use.

The AT-800 has an in-built, fast sweep frequency source enabling VSWR, match efficiency and return loss tests across the entire band. A single frequency mode allows precise tuning/troubleshooting which is especially useful for intermittent problems. Pass/fail limits can be programmed for quick 'go/no go' tests, and an audible tone, with variable pitch proportional to the antenna match, to make VSWR tuning easy.

Special features of the AT-800 include battery save feature, cable loss offset, field strength testing and automatic peak mismatch find. Of critical importance for all users of RF test equipment, and especially users of the AT-800, is the availability of local support and calibration. Vicom's well equipped Melbourne laboratory offers NATA registration, and offices in Sydney, Melbourne, Perth, Brisbane and Auckland can offer considerable support on a very local basis.

For further information circle 248 on the reader service coupon or contact Vicom Australia, 18-20 Orion Road, Lane Cove 2066; phone (02) 418 3100.

Drill/driver for tight corners

The Cornermaster drill/driver by Panasonic is the latest edition to the Predator series, and has a specially designed revolving mechanism that allows it to be used in areas too tight for a conventional power tool.

Known as the EY6780CQK, the Cornermaster has the drill chuck located in an offset position. This configuration allows it to drive screws and drill holes with only an 8mm clearance between the drill or screw bit and the surface being worked against.

The drill/driver has a 1/4" (6.5mm) quick-connect check with settings at 45° intervals, providing a total of eight settings. The result is that whether the user is right or left handed, and whether the area being worked in is horizontal or vertical, corner or undercounter, a bit position can be found that is efficient and comfortable. It also has a 22 stage clutch which allows the clutch to be set according to the type and thickness of the material being worked on.

The unit has the Panasonic 15 minute 'coffee break' charge system, which fully charges the 9.6 volt battery in 15 minutes.

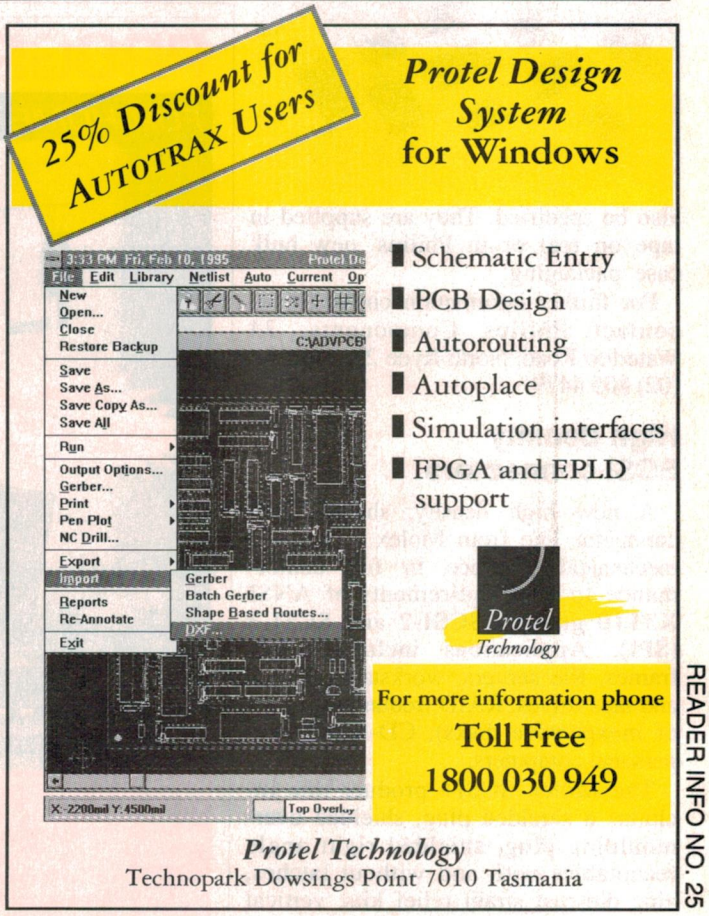
The recommended retail price of the drill/driver is $479.

For further information contact Panasonic's Customer Care Centre on 132 600. ❖





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Portable and Affordable RF Isolation

Triplett Corporation is proud to introduce the Isolator 144 RF Isolation Test Chamber. This portable box eliminates the need for expensive screen rooms while providing the necessary isolation to allow for proper testing of cellular phones and pagers. And, since it's portable, you can take it wherever it's needed.

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READER INFO NO. 26

Silicon Valley NEWSLETTER



Apple asks FCC for 'NII' radio band

If Apple Computer gets its way, institutions in the USA ranging from schools, libraries and community groups, along with individuals and businesses will be able to transmit computer data at extremely high speeds over a so-called 'NII Band' in the radio spectrum. The NII Band radio service would be accessible by equipment from any supplier and available to anyone without licensing or air-time charges, to facilitate wireless participation in the development of America's National Information Infrastructure.

Apple said it has asked the Federal Communications Commission to create the NII Band, following the success of its five-year effort to obtain FCC frequency allocation for unlicensed data personal communications services (Data-PCS).

Data-PCS allows computing devices to communicate by radio at relatively high data rates within a local area, such as throughout a school.

Because the Data-PCS band is unlicensed, a user may establish and operate a wireless data communications network without paying a service provider for installation and air-time. The NII Band would allow for both faster data rates, and also allow users for the first time to set up their own wideband wireless data links spanning 7 - 9 miles (10 - 15km) or more.

"This NII Band promises to be a breakthrough, extending the NII beyond any other wired or wireless telecommunications service," said David Nagel, Apple's senior vice president of Worldwide Research and Development, who submitted both the present proposal and Apple's 1991 Data-PCS petition to the FCC.

One portion of the NII Band (5150-5300MHz) has already been earmarked for use in Europe for local area wireless networks, and adheres to the HIPERLAN network standard deve- loped by companies including Apple. The band rules for the proposed NII Band in the US would permit HIPERLAN-compliant products as well as many other network technologies.

By enabling US manufacturers to develop products for use in both the NII Band and for European HIPERLAN networks, the NII Band could increase US competitiveness and create new export opportunities. In addition, interoperability between US and European HIPERLAN technologies can advance the development of the Global Information Infrastructure (GII), Nagel said.



Now we know why so many of the US conventions are held in Las Vegas! One of the attractions of that city is Luxor, the hotel billed as 'The next Wonder of the World'. Its entrance boasts a 10 storey replica of the Great Sphinx of Giza, and a water screen depicting Egyptian holographs.

Fully digital movie production

Silicon Graphics and Dreamworks, the new Hollywood movie studio co-founded by film director Steven Spielberg, have announced a US$50 million agreement to jointly develop the world's first end-to-end fully digital movie production studio.

Spielberg, his Dreamworks partner Jeffrey Katzenberg and Silicon Graphics chief Ed McCracken said the agreement means far more than the $50 million the parties have agreed to spend on installing powerful graphics workstations, sophisticated animation software and high-speed networking equipment in their new studio. They predicted their alliance will revolutionise the movie and computer industries alike, as well as the pictures that moviegoers will see.

"Audiences expect extraordinary visual experiences," said Katzenberg. "Our ambition is to do things that people have never seen before." Ambitions such as that, however, usually cost a lot of money.

To make their new venture competitive with established studios, Katzenberg, Spielberg and their third partner, music producer David Geffen, are counting on the declining cost of computer power to save money and increase their profits on the products they spin off from their movies. Silicon Graphics already helped create special effects for blockbuster hit films such as *Jurassic Park*, *Terminator II* and the just-released *Casper*, which features human characters created entirely inside a workstation. "The computers can actually act," Spielberg said.

The deal cements a relationship with Hollywood's hottest producers. McCracken predicted a rush by other

studios that would more than triple Silicon Graphics' sales to the entertainment industry to US$1 billion by the end of the decade.

The Dreamworks Digital Studio, as the effort is being called, will be built in Dreamworks' yet-to-be located headquarters in Los Angeles. The team said the first project, dubbed the Digital Animation Dreammachine or 'DAD', will be ready in September 1996 for use in Dreamworks' first production, an animated film called *Prince of Egypt*, loosely based on the Bible's 10 commandments.

Spielberg said the use of technology "allows me to continue to dream, without having anyone cut my budget. The whole idea to bring costs down in the movie industry is to make technology an ally."

The objective of the digital studio idea is to link pre-production development, production, editing, storage and distribution in a single computer network, with the ability to easily re-use the same material for TV shows, musical soundtracks, video games, interactive Internet sites and even toy production.

'Deep Blue' to take on Kasperov

World chess champion Gary Kasperov wants revenge. After being embarrassed in a five-minute chess game by a chess computer, Kasperov has agreed to battle it out in a real, regulation length, six-game match with the leading digital chess machine, the 'Deep Blue' system from IBM.

The match will take place next February in Philadelphia, as part of the 50th anniversary celebration by the Association for Computing Machinery (ACM). IBM scientists, who have spent years building Deep Blue, said the match represents the culmination of their efforts to design and assemble a computer hardware and software system endowed with the ability to compete in full-length, regulation chess at the level of the human world champion.

In preparing for that ultimate confrontation, Deep Blue will be tested this year by challenging several chess grandmasters from different parts of the world.

The Deep Blue system is a scalable, parallel computing system with hundreds of special accelerator chips custom designed by the computer-chess group and attached to a powerful IBM host computer. By February, Deep Blue will run more than 100 times faster than today's existing system, Deep Blue Prototype, allowing it to analyse nearly one billion chess positions per second.

The IBM Deep Blue computer-chess project began in late 1989 when the Deep Thought team from Carnegie Mellon University joined IBM Research. At IBM they worked on upgrading the system, the team's first world champion. The result of their efforts, now called Deep Blue Prototype, was 10 times faster than its predecessor. Among its most recent achievements was its victory last June in becoming the International Computer Chess Champion.

Equipment sales boom

As semiconductor manufacturers scramble to add new capacity, sales of the machines that will equip the new generation of multi-billion dollar semiconductor wafer fabs is booming. After growing more than 40% in 1994, the semiconductor equipment industry is on a path towards achieving a growth rate in excess of 50% this year, according the latest figures from the Semiconductor Equipment & Materials International (SEMI) trade organisation in Mountain View.

Shipments from US-based manufacturers reached US$936.3 million in April, 53% above the sales level a year ago. New bookings reached US$1.2 billion for the month, an increase of no less than 78% from April 1994 levels, according to the SEMI group.

Measured by sector, manufacturing equipment shipments for April totalled US$696.6 million, while test equipment shipments reached $187.4 million. Assembly and packaging equipment shipments totalled $52.3 million.

'PC SALES TO DOUBLE BY 1999'

Sales of personal computers will double to 100 million units a year by the year 1999, according to Intel chief executive Andrew Grove.

Computers are becoming increasingly powerful, come with more features, yet cost less than previous generations, and this will drive the move of the PC into the home, Grove said in a speech during a personal computer symposium in Burlingame near San Francisco this week.

Today, high-end PC prices have fallen to around US$2000, down from an average of $6000 in 1991, Grove said. Already, the consumer PC market is the fastest growing segment in the overall PC market, which measured 48 million units sold in 1994.

Packard writes first book at 83

Things were quite different in 1939, when Dave Packard and Bill Hewlett started Silicon Valley in their Palo Alto garage, and turned the venture into one of America's greatest business success stories.

Back then "You could live on $3 a day," Packard recalled a few weeks ago at a news briefing held for his new book *The HP Way* (Harper Business).

To launch the book Packard and his partner Hewlett held a rare press conference. The two men said they started their business to get jobs. "We had not the slightest idea how big the company would become", Packard said.

The two men got along well from the start. Packard recalled 'no big arguments' or 'serious problems' over the years, with people inside or outside the company.

Unlike most electronics start-ups today, Hewlett-Packard was able to grow slowly. "We had fewer than 200 people for the first 10 years", Packard said. Sales were only US$30 million in 1958; they reached $1 billion in 1976 (H-P is expected to have about US$30 billion in sales this year). The company was able to grow mainly on reinvested profits, rather than by incurring debt and selling stock.

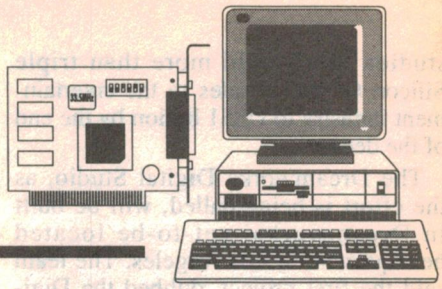
Another advantage to the company's comparatively slow growth was that the founders had time to develop the corporate culture that has contributed so much to Hewlett-Packard's success. In the company's first decade, the two founders knew every family. This closeness — and their concern and compassion for employees — helped them develop the now famous 'H-P Way' philosophy, values and corporate traditions.

Despite the tremendous changes in the electronics world, Packard remains optimistic about this country's prospects. "While we will face strong competition from Asia, the United States will continue to be at the front."

His eyes gleamed with pride as he described high-tech university fellows being funded by the Packard Foundation. "You have never seen a brighter, more articulate group of young people", he said.

Packard displayed a sense of humour when a reporter asked if he had any personal or professional regrets. "If I had studied more instead of playing football at Stanford", he said with a straight face, "I probably would have gone a little further." ❖

Computer News and New Products

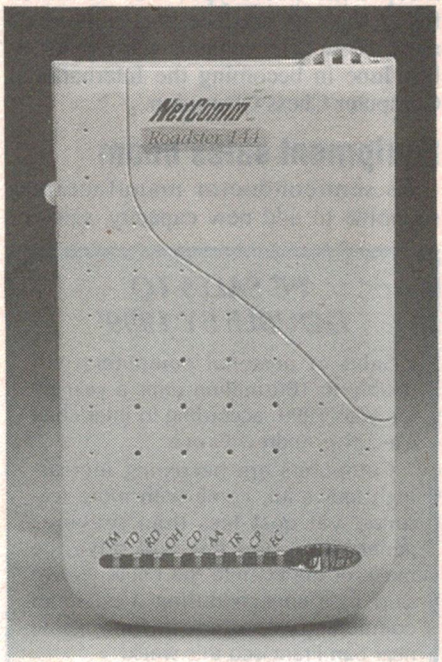


New modems from NetComm

NetComm has released three new modem ranges: the Roadster modems for compact high speed data and fax transfer, the InModems for internal use in PCs, and the CardModems for connection to cellular and standard telephone lines.

The Roadster series is a new range of compact external high speed modems, which includes the Roadster 144, Roadster 144P (portable) and Roadster 288, allowing the user to transmit and receive faxes and data directly from a desktop or portable computer. The Roadsters will eventually replace the existing AutoModem range.

The series features a new compact case design measuring 70 x 125 x 20mm, approximately 1/3 the size of the current AutoModem. The Roadster 144P is battery powered for total portability. Other design features include top mounted LEDs for easy viewing of modem status, an in-built full size speaker and an integrated quick connect serial cable.



The new InModem range offers modems for PC to PC and fax communications, for internal use in IBM compatible PCs (ISA/EISA Bus).

NetComm's CardModems connect to the analog cellular network or standard telephone lines to provide mobile data and fax communications. The CardModem V.34 (CM3400) and CardModem V.32 bis (CM170) are credit card sized, asynchronous modems which use the PCMCIA Type II interface slot found in most portable personal computers and have low operating power requirements to maximise battery life. The CM1710 supports transmission rates up to 14,400b/s and has auto-dial and auto-answer. With the in-built compression features the CM1710 can support data trhoughput up to 57,600b/s. The CM3400 has the same fax capabilities as the CM1710, but supports data speeds up to 28,800b/s, and 115,200b/s using the compression option.

For further information circle 162 on the reader service coupon or contact your nearest NetComm dealer.

Frame grabber for hi-res applications

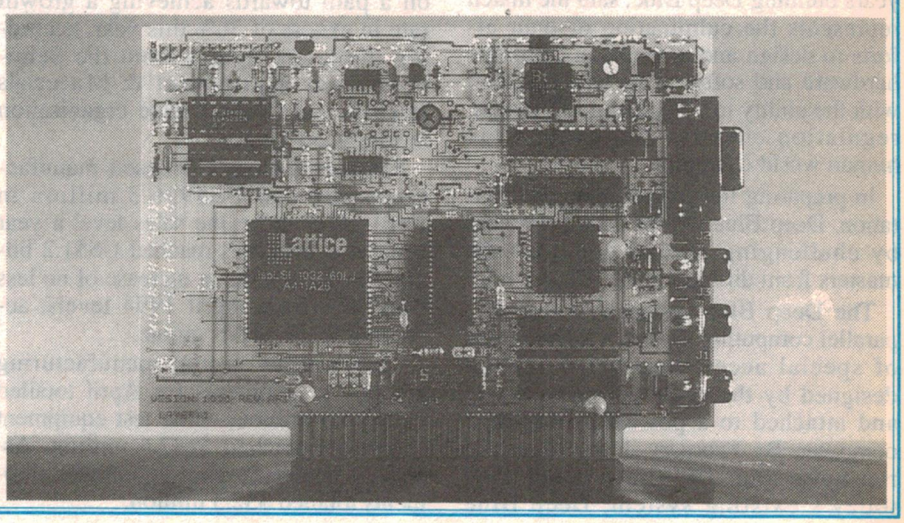
MuTech has introduced the M-Vision 200, a new, high quality greyscale PC compatible frame grabber, primarily intended for industrial vision applications.

The M-Vision 200, which accepts video inputs from standard cameras, is targeted at OEMs and systems integrators in machine vision, industrial automation, security, and medical imaging. These applications require superior video quality, high pixel accuracy, and low distortion, with multiple camera support.

The frame grabber is a half-slot ISA bus card which captures video from any RS-170 or CCIR video source in 1/25th of a second. The device produces digital images with 256 grey scale depth (eight bits) in either high resolution (512 x 512 pixels), or low resolution mode (256 x 256 pixels). The low resolution mode can be set to operate on 1/50th second fields, rather than full frames (1/25th second) for situations where object motion is a problem. Image capture results are stored in fast on-board, memory mapped VRAM, buffering the vision system from the delays inherent in ISA bus data transfers.

To ensure the highest possible image quality, the card uses a phase-lock-loop with a pixel jitter of +/-10ns, which is approximately 0.1 pixel at an image resolution of 512 x 512 pixels. Low jitter ensures sharp images, higher quality processing results, and more accurate measurements.

For further information circle 161 on the reader service coupon or contact The Dindima Group, P.O. Box 106, Vermont 3133; phone (03) 9873 4455.



600dpi, A3 printer has fax/modem

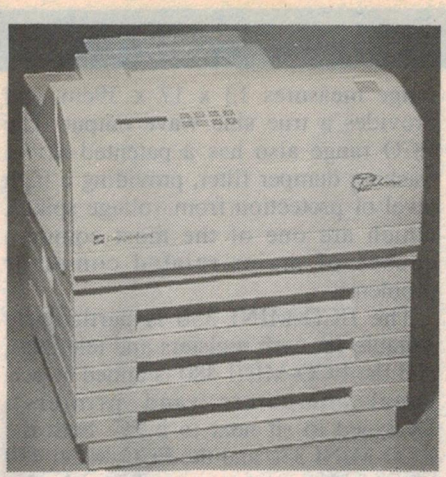
Dataproducts has announced the Typhoon 16, a RISC-based 16 page-per-minute network laser printer with 600dpi resolution, full bleed A3 imaging, Adboe PostScript Level 2, PCL5+ and 7475A emulations, 12MB memory, up to three paper trays and a PostScript fax/modem option for up to 600dpi faxing.

The printer incorporates a 'new generation' engine designed for high speed and high volume A3 output with maximum paper handling flexibility.

The printer has up to four input bins for a total paper capacity of 1000 sheets and is claimed to have the fastest FPOT (first page out time) of any printer in its class, of around 10 seconds for a standard A4 document with 5% coverage.

Rated at 30,000 pages per month, the printer provide 600 x 600dpi print resolution and uses Dataproducts' new seven micron toner system which is claimed to provide cleaner edges, better graphics and reduced toner scatter.

The printer's optional PostScript and CCITT group fax/modem can send and receive documents at up to 600dpi resolution. Documents faxed to the printer from any PostScript equipped fax/modem will be printed at 600dpi,



regardless of the PostScript resolution of the originatingsystem.

The printer's standard connectivity supports RS-232-C/RS-422 serial, LocalTalk and bidirectional or undirectional parallel connections. Optional connectivity includes Ethernet with VPT 3.0 (10base2/10baseT or Token Ring). A SCSI connector is provided for optional hard disk attachment. The Typhoon 16 printer with one tray, 12MB of memory and 600dpi has a recommended retail price (including tax) of $5285.

For further information circle i70 on the reader service coupon or contact Dataproducts, 10 Rodborough Road, Frenchs Forest 2086; phone (02) 451 3533.

Picture Publisher for Windows 95

Micrografx has announced the availability of a beta version of its image editor software, Picture Publisher, for Windows 95. Micrografx claims this application is the most complete multi-threaded and multi-tasking product currently available, and demonstrates the true productivity and performance enhancements provided by the new Microsoft operating system.

The Windows 95 version of Picture Publisher is offered to all registered Windows 95 beta users in Australia for a cost of $45 plus handling. These registered users will be invited to upgrade to the final release product, due within 30 days of Microsoft's Windows 95 launch. Existing users of Micrografx Picture Publisher who are also Windows 95 beta reviewers can receive the beta Picture Publisher at no charge other than handling costs.

Support for the product is via Compuserve (GO MICROGRAFX) or by fax, through the local Sydney office to the USA based beta support team. While the beta product is deemed by Micrografx to be mature, it is not guaranteed

PC Breeze II

"PCBreeze really is a breeze."

Herman Nacinovich, ETI review "It's a Breeze" Jan. 1990.

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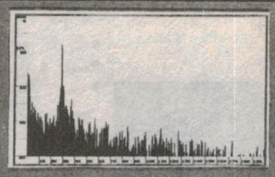
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to be bug free. It is not suggested the beta product be used for critical applications.

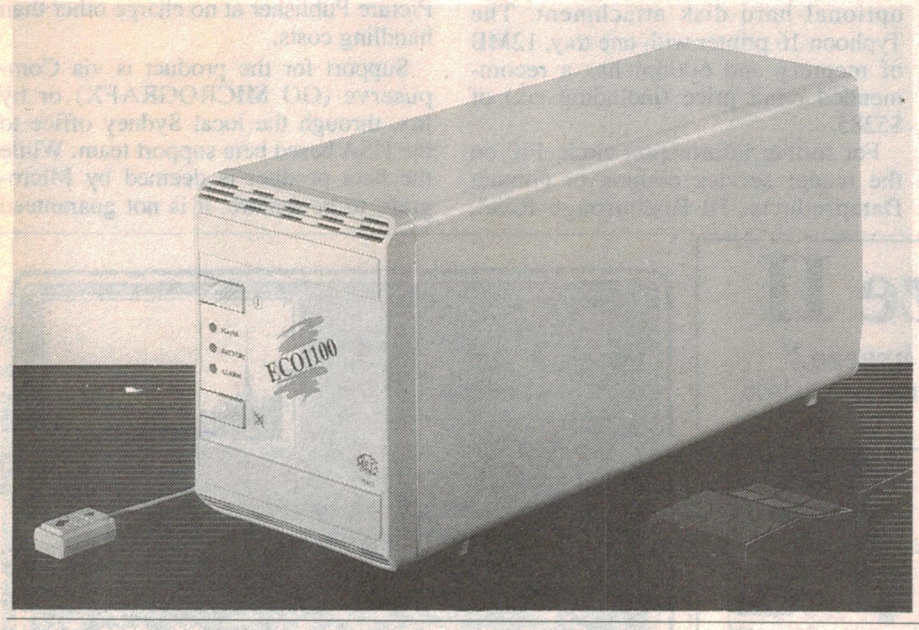
Desktop UPS for PC users

The release of a new range of very compact desktop high performance uninterruptible power supplies (UPS) has been announced by Meta System. The ECO and ECO-MINI UPS family comprises five models covering the power range of 330VA to 1100VA. They are designed to protect personal computers, network file servers and other electronic systems from potentially damaging voltage fluctuations such as sags, spikes and transients, and total mains failures.

Each unit in the ECO-MINI range measures 9 x 16.5 x 23.5cm and provides a stepwave approximation of a sinusoidal waveform, with correct peak and RMS values. Each unit in the ECO range measures 13 x 17 x 39cm, and provides a true sine wave output. The ECO range also has a patented active tracking dumper filter, providing a high level of protection from voltage spikes, which are one of the most common causes of mains-related computer problems.

The ECO-MINI 330 is particularly suitable for cash registers and telefaxes, and the ECO-MINI 480 is aimed at personal computers (and printers). Designed to sit next to a PC, both the ECO-MINI 330 and the ECO-MINI 480 come with a remote control, so it's also possible to locate them at a distance. An output for a computer interface (with optional software for the major operating systems) and a sophisticated battery efficiency test are further features.

For further information circle 169 on the reader service coupon or contact Westinghouse Industrial Products, Locked Bag 66, South Melbourne 3205; phone (03) 676 8888.



Workstation has touch screen

Click Electronics has released a rack mounting workstation with a built in touch screen. The integrated touch screen is supplied with drivers for DOS or Windows 3.x.

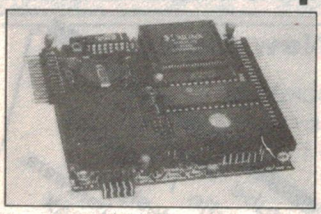
The workstation has a sealed front panel, to NEMA 4 (IP56)/NEMA 12 (IP52), with an integral 83-key membrane keypad which includes 24 function keys. The workstation can accommodate one 3.5" floppy disk drive, and two 3.5" half height hard disk drives. The integral VGA 14" 0.26mm dot pitch colour monitor has a maximum resolution of 1024 x 768.

Fitted with a seven slot AT-ISA passive backplane which is mounted with the hard disk and floppy disk drives in a slide out drawer from the rear, the touch station has easy access for easy assembly. The card bay is fitted with an anti-vibration clamp to ensure all cards remain in position even in the harshest of environments. It has a 250W power supply.

Configuration can be from a low cost 486DLC processor card to a high performance 486DX4-100 with integrated VL-bus SVGA and SCSI-2 interface. All single board computers to go with the touch station are rated for 0 - 60°C operating temperature, have a battery backed real time clock, two serial ports, one parallel port, a floppy disk controller, and IDE hard disk interface support for two hard disk drives and a watch dog timer.

For further information circle 165 on the reader service coupon or contact Click Electronics, PO Box 25, Bangor 2234; phone (02) 649 6011. ❖

Australian Computers & Peripherals from JED... Call for data sheets.



Australia's own PC/104 computers.

The photo to the left shows the JED PC540 single board computer for embedded scientific and industrial applications. This 3.6" by 3.8" board uses Intel's 80C188EB processor. A second board, the PC541 has a V51 processor for full XT PC compatibility, with F/Disk, IDE & LPT. Each board has two serial ports (one RS485), a Xilinx gate array with lots of digital I/O, RTC, EEPROM. Program them with the $179 Pacific C. Both support ROMDOS in FLASH. **They cost $350 to $450 each.**

$125 PROM Eraser, complete with timer

$300 PC PROM Programmer.



(Sales tax exempt prices)

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This little box simply plugs into your PC or Laptop's parallel printer port and reads, writes and edits PROMs from 64Kb to 8Mb. It does it quickly without needing any plug in cards.

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FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...

Your Complete Guide To The Huge Range of CONNECTORS from Geoff Wood (Part 1)

Following the popularity of our Semiconductor Listing we're listing all our connectors over the next couple of months – *just to show you how comprehensive our range is.* We suggest you photocopy or save this page for future reference!

ALLIGATORS

AC26.B	26mm Black Allig.Clip	$0.30
AC26.R	26mm Red Allig.Clip	$0.30
AC32.B	32mm Black Allig.Clip	$0.35
AC32.R	32mm Red Allig.Clip	$0.35
AC34.B	34mm Blk Allig. Clip	$0.40
AC34.R	34mm Red Allig. Clip	$0.40
AC65.B	65mm Black Allig.Clip	$0.55
AC65.R	65mm Red Allig.Clip	$0.55

BNC

BNC1	RG58 5.3mm	$3.05
BNC1-R/A	Right Angle BNC Crimp	$12.40
BNC1CT	BNC Crimp Plg	$2.45
BNC1ST	COAX Plg Screw/Crimp	$3.30
BNC1TT	BNC Twist on Plg	$3.80
BNC2	BNC Panel Skt	$2.30
BNC3	3 Female Tee	$7.15
BNC4	BNC Coupler	$3.45
BNC6	2 Female, 1 Male Tee	$7.15
BNC8	Y Shape 1 Plug 2 Socket	$10.95
BNC9	R/A Socket to Plug	$5.05
BNC10	RG59 6.3mm	$2.80
BNC12	BNC Insltd Chassis Skt	$3.05
BNC13	RG58 Crimp Chassis Skt	$3.45
BNC-TERM-50ohm	BNC Terminator	$2.95

BANANA

BP4.B	4mm Blk Banana Plg	$0.80
BP4.R	4mm Red Banana Plg	$0.90
BP4L.B	4mm Banana Plg w/Link	$1.60
BP4L.R	4mm Banana Plg W/Link	$1.60
BP4M.B	4mm Black Banana Plg	$1.90
BP4M.R	4mm Red Banana Plug	$1.90
BP4S.B	4mm Stkbl Banana Plg	$2.25
BP4S.R	4mm Stkbl Banana Plg	$2.25
BS4.B	4mm Chassis Skt	$0.65
BS4.R	4mm Chassis Skt	$0.65

AUDIO

MONO

C25.B	2.5mm Inline Skt	$1.10
C25.R	2.5mm Inline Skt	$1.00
C35.B	3.5mm Inline Skt	$1.00
C65.B	6.35mm Inline Skt	$1.50
C65.R	6.35mm Inline Skt	$1.50
C65.M	6.35mm Metal Skt	$2.65
J25	2.5mm Mono Skt	$1.30
J35	3.5mm Mono Chassis Skt	$1.30
J35C	3.5mm Chassis Skt	$0.70
J35S	3.5mm Mono Closed Skt	$1.30
J65	6.35mm Mono Clsd Skt	$1.65
P25.B	2.5mm Plg	$0.75
P25.R	2.5mm Phone Plg	$0.75
P35.B	3.5mm Plg	$0.75
P35M	3.5mm Metal Plg	$1.25
P35P	3.5mm Phone Plg	$0.60
P35.R	3.5mm Phone Plg	$0.75
P65.B	6.35mm Mono Phone Plg	$1.10
P65M	6.5mm Metal Plg	$1.80
P65.R	6.35mm Mono Plg	$1.10
P65MA	6.35 Mono Mtl Plg	$2.05
P65P	6.5mm Phone Plg	$1.10

STEREO

CS35	3.5mm Stereo Inline Skt	$1.60
CS65.B	6.35mm Stereo Skt-Plastic	$1.55
CS65.M	6.35mm Stereo Mtl Skt	$2.85
CS65.R	6.35mm Stereo Inln Skt	$1.55
JS35	3.5mm Stereo Closed Skt	$1.30
JS65	6.5mm Stereo Clsd Skt	$2.45
JS65.C	6.35mm Stereo Dbl Close	$2.75
PS25	2.5mm Stereo Plg	$2.25
PS35.B	3.5mm Stereo Plg	$1.25
PS35M	3.5mm Stero Metal Plg	$1.70
PS35.R	3.5mm Stereo Plg	$1.25
PS65.B	6.35mm Mono Phone Plg	$1.55
PS65M	6.35mm Stereo Plg	$2.30
PS65.P	6.35mm Stereo Phone Plg	$1.55

CANNON

CAN-AXR-3-11	3 Pin Inline Fem Plg	$7.85
CAN-AXR-3-11-B	Cannon Socket	$7.90
CAN-AXR-3-12	3 Pin Inline Male Plg	$7.30
CAN-AXR-3-21	Female Chassis Skt	$9.50
CAN-AXR-3-22	Cannon Skt	$6.55
CAN-AXR-3-31	3 Pin Inline Fem Plg	$8.80
CAN-AXR-3-32	3 Pin M Chassis Skt	$5.95
CAN-AXR-3-34	Male Chassis Skt	$6.80
CAN-AXR-4-11	4 Pin Inline Fem Plg	$12.95
CAN-AXR-4-12	Cannon Plug	$9.85
CAN-AXR-4-31	4 Pin Fem Chas Skt	$13.30
CAN-AXR-4-34	Male Chassis Skt	$7.70
CAN-AXR-5-11	5 Pin Inline F. Plg	$18.95
CAN-AXR-5-12	5 Pin Inline M. Plug	$11.95
CAN-AXR-5-31	5 Pin F. Chassis Skt	$18.15
CAN-AXR-5-34	Male Chassis Skt	$11.05
CAN-AXR-LNE-11	3 P. 250V F. Plg	$16.95
CAN-AXR-LNE-12	3 P. 250V M. Plg	$16.95
CAN-AXR-LNE-31	3 P. 250V F. Skt	$12.90
CAN-AXR-LNE-32	3 P. 250V M. Skt	$12.00
CAN-AXR-JNR-FML	3 Pin AXR Joiner F/F	$9.95
CAN-AXR-JNR-MALE	3 Pin AXR Joiner M/M	$8.95

CENTRONICS

SOLDER

CENT-14-PLG	Centronics Cable Plg	$4.35
CENT-14-SKT	Centronics Cable Skt	$6.35
CENT-24-PLG	Centronics Cable Plg	$5.95
CENT-24-SKT	Centronics Cable Skt	$12.00
CENT-36-PLG	Centronics Cable Plg	$3.35
CENT-36-SKT	Centronics Cable Skt	$5.35
CENT-50-PLG	Centronics Cable Plg	$8.40
CENT-50-SKT	Centronics Cable Skt	$10.85

CENTRONICS-IDC

IDC-CENT-24-PLG	Centr. IDC Plg	$8.40
IDC-CENT-24-SKT	Centr. IDC Skt	$7.90
IDC-CENT-36-PLG	Centr. IDC Plg	$6.55
IDC-CENT-36-SKT	Centr. IDC Skt	$6.00
IDC-CENT-50-PLG	Centr. IDC Plg	$12.55
IDC-CENT-50-SKT	Centr. IDC Skt	$10.75

DC PLUGS & SOCKETS

DC10	1mm DC Plug-SANYO	$1.30
DC13	1.3mm DC Plug-SANYO/AWA	$1.30
DC16	1.6mm DC Plg	$1.20
DC21	2.1mm DC Plg	$1.20
DC25	2.5mm DC Plg	$1.20
DC31	3.1mm Plug-JVC	$1.30
DJ21	2.1mm DC Skt	$1.10
DJ21C	2.1mm Chassis Skt	$2.25
DJ21P	2.1mm PCB Mount Skt	$0.95
DJ25	2.5mm DC Skt	$1.10
DJ25P	2.5mm PCB Mount Skt	$0.95

DIN PLUGS & SOCKETS

DIN-JD2	2 Pin DIN Skt	$0.70
DIN-JD3	3 Pin Panel Mount Skt	$1.00
DIN-JD4	4 Pin Panel Mount Skt	$1.20
DIN-JD5	5 Pin DIN Chassis Skt	$1.40
DIN-JD5A	5 Pin Domino Panel Skt	$1.35
DIN-JD6	6 Pin Panel Mount Skt	$1.50
DIN-JD7	7 Pin DIN Metal Skt	$1.55
DIN-JD8	8 Pin 270d DIN Mtl Skt	$1.70
DIN-JD8A	8 Pin DIN Panel Skt	$1.65
DIN-PD2	2 Pin DIN Plg	$0.80
DIN-PD3	3 Pin DIN Plg	$1.00
DIN-PD4	4 Pin DIN Plg	$1.05
DIN-PD5	5 Pin DIN Plg 180 Deg	$1.00
DIN-PD5B	5 Pin DIN Plg 240 Deg	$1.10
DIN-PD5M	5 Pin DIN Plg	$5.45
DIN-PD6	6 Pin Plug-Shielded	$1.20
DIN-PD7	7 Pin Plug-Shielded	$1.30
DIN-PD8	8 Pin 270 Degree Plg	$1.40
DIN-PD8A	8 Pin DIN Plg	$1.35
DIN-PDM3	3 Pin Micro DIN Plg	$2.55
DIN-PDM4	4 Pin Micro DIN Plg	$2.55
DIN-PDM5		$2.65
DIN-PDM6	6 Pin Micro DIN Plg	$2.75
DIN-PDM7		$2.90
DIN-PDM8	8 Pin Micro DIN Plg	$3.05
DIN-RA-SKT	RA 5 Pin DIN Skt MAB5SH	$2.80
DIN-SD2	2 Pin DIN Skt	$0.70
DIN-SD3	3 Pin Inline Skt	$1.05
DIN-SD5	5 Pin 180 Degree Skt	$1.35
DIN-SD5A	5 Pin Domino Skt	$1.30
DIN-SD5B	5 Pin DIN Inline Skt	$1.35
DIN-SD6	5 Pin DIN Skt	$1.40
DIN-SD7	7 Pin DIN Skt	$1.40
DIN-SD8	8 Pin 270 Degree Skt	$1.70
DIN-SD8A	8 Pin DIN Inline Skt	$1.65
DIN-SDM4	4 Pin Mini DIN Line Skt	$2.50
DIN-SDM6	6 Pin Mini DIN Line Skt	$1.45
DIN-SDM8	8 Pin Mini DIN Line Skt	$1.45

ZERO INSERTION

IC-TEXTOOL-16	16 Pin ZIF Skt	$21.45
IC-TEXTOOL-20	20 Pin ZIF Skt	$30.95
IC-TEXTOOL-24	24 Pin ZIF Skt	$26.40
IC-TEXTOOL-28	28 Pin ZIF Skt	$29.20
IC-TEXTOOL-40	40 Pin ZIF Skt	$48.70

RCA

RCA1.B	RCA Inline Skt	$0.55
RCA1.R	RCA Inline Skt	$0.55
RCA1.Y	RCA Inline Skt	$0.55
RCA1.W	RCA Inline Skt	$0.55
RCA1M.B	RCA Inline Skt	$1.30
RCA1M.R	RCA Inline Skt	$1.30
RCA2.B	RCA Plug Plastic	$0.55
RCA2.R	RCA Plug Plastic	$0.55
RCA2.Y	RCA Plug Plastic	$0.55
RCA2.W	RCA Plug Plastic	$0.55
RCA2M.B	RCA Plug-Metal	$1.30
RCA2M.R	RCA Plug Metal	$1.30
RCA3B	RCA Chassis Skt	$0.80
RCA3R	RCA Chassis Skt	$0.80
RCA3I	RCA Chassis Skt	$0.90
RCA32	Terminal Board 2 Skts	$1.05

SCSI

SCSI-INLINE-TERM	SCSI Terminator 50M/50F	$19.95
SCSI-TERMINATOR	50 Ohm SCSI Terminator	$13.95
SCSI/SCSI-2	50 Pin SCSI-1 to SCSI-2	$59.95

TELEPHONE

TEL-CNC6	6 x 6 US Plg to US Skts	$4.05
TEL-CNC7	Inline 6 x 4 Joiner	$4.00
TEL-RJ45-JOINER	RJ45 Inline Join	$3.70
TEL-CNC8	6 x 6 US Entry Box	$3.55
TEL-CNC10	6 x 6 US Entry Box	$4.10
TEL-CNC11	Dual 6 x 6 US Entry	$8.15
TEL-CNL9	6 x 6 Extension Cable	$8.20
TEL-CNL11	5M 6 x 6 Dual Extn	$9.10
TEL-CNL16	5M 6 x 6 Plg to Plg	$7.20
TEL-PT1	Telephone Plg	$5.10
TEL-PT2	Telephone Skt	$5.65
TEL-PT3	Telephone Entry Box	$5.65
TEL-PT5	Telephone Plug	$7.15
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TEL-PT18	PCB 8 x 8 Skt	$4.55
TEL-PT25	US Plg to Dual US Skts	$10.05
TEL-PT35	RJ45 Patch Cord 2 Metre	$4.95
TEL-PT35L	RJ45 8 Way 5 Metres	$6.45
TEL-PT28	RJ45 Dual Adaptor	$8.25
TEL-PT44	Plug-4 Slot 4 Pin Wired	$3.10
TEL-PT64	6 x 4 Modular Plug	$3.25
TEL-PT66/5	6 x 6 Modular Plug	$3.95
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TEL-2C	Australian Plg to 2 Skt	$10.20
TEL-2D	Telephone Dual Adaptor	$11.10
TEL-3	Telephone Dual Adaptor	$20.35
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TEL-5	2.5M Extension Cable	$12.35
TEL-6	10M Extn Cable	$18.40
TEL-8	Aust Plug to US Skt	$7.05
TEL-9	6 x 4 Extension Cable	$7.65
TEL-11	5M 6 x 4 Dual Extn	$7.15
TEL-14.C	4 x 4 Curly Cord	$5.50
TEL-16	5M 6 x 4 Plg to Plg	$4.50
TEL-18	5M 8 x 8 Plug to Plug	$6.95
TEL-21	Telephone Extn Bell	$30.25

SOLDER D TYPE

9 PIN

D-09/09-SHELL	9 to 9 Shell	$2.90
D-09/25-SHELL	9 to 25 Shell	$3.05
D-09-PLG	9 Pin Solder Plg	$0.60
D-09-SHELL-MTLSD	9 Pin Backshell	$1.05
D-09-SKT	9 Pin Solder Skt	$0.50
D-09-SHELL	9 Pin Backshell	$0.55
D-09-PLG-RA-7.2M	9 P. R/A Plg Sh	$1.10
D-09-SKT-RA-7.2M	9 P. R/A Skt Sh	$1.20

15 PIN HIGH DENSITY

D-0915-PLG	9 Pin Shell W/ 15 Pins	$1.55
D-0915-SKT	9 Pin Shell W/ 15 Pins	$1.55
D-0915-SKT-RA-7	H. D. 15 Pin PCB	$2.00

15 PIN

D-15-PLG	15 Pin Solder Plg	$0.90
D-15-PLG-RA-7.2M	15 P.R/A Plg Sh	$2.00
D-15-SKT	15 Pin Solder Skt	$0.90
D-15-SKT-RA-7.2M	15 P.R/ASkt Sh	$1.55
D-15-SHELL	15 Pin Backshell	$0.70
D-15-SHELL-MTLSD	15 P. Met Shell	$1.10

19 PIN

D-19-PLG	19 Pin Solder Plg	$1.60
D-19-SKT	19 Pin Solder Skt	$1.60
D-19-SHELL		$1.00

23 PIN

D-23-PLG	23 Pin Solder Plg	$1.90
D-23-SKT	23 Pin Solder Skt	$1.35
D-23-SHELL	23 Pin Backshell	$1.55

25 PIN

D-25/25-SHELL	25 to 25 Shell	$1.80
D-25-PLG	25 Pin Solder Plg	$1.00
D-25-PLG-RA-7.2M	25 P.R/A Plg Sh	$1.75
D-25-PLG-STR-PCB	25 P. Str P PCB	$3.60
D-25-SKT	25 Pin Solder Skt	$1.00
D-25-SKT-RA-7.2M	25 P.R/A SktSh	$1.88
D-25-SHELL	25 Pin Backshell	$0.65
D-25-SHELL-MTLSD	25 P. Met Shell	$1.10

37 PIN

D-37-PLG	37 Pin Solder Plg	$1.70
D-37-SKT	37 Pin Solder Skt	$1.70
D-37-SHELL	37 Pin Backshell	$1.90

50 PIN

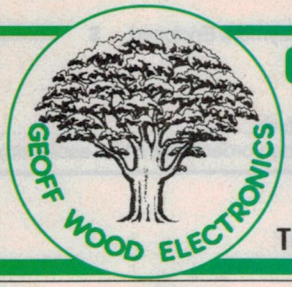
D-50-PLG	50 Pin Solder Plg	$4.85
D-50-SKT-RA-7.2M		$6.95
D-50-SKT	50 Pin Solder Skt	$4.85
D-50-SHELL	50 Pin Backshell	$3.90
D-HEX-NUTS/50		$8.00
D-JACK-SCREWS	Jack Screws/Pair	$0.60

IDC D TYPE

IDC-D09-PLG	9 Pin IDC D Plg	$3.80
IDC-D09-SKT	9 Pin IDC D Skt	$3.80
IDC-D15-PLG	15 Pin IDC D Plg	$3.80
IDC-D15-SKT	15 Pin IDC D Skt	$3.88
IDC-D25-PLG	25 Pin IDC D Plg	$4.30
IDC-D25-SKT	25 Pin IDC D Skt	$3.75
IDC-D37-PLG	37 Pin IDC D Plg	$6.70
IDC-D37-SKT	37 Pin IDC D Skt	$9.25

See June issue for Machine Sockets, Headers and Transition Sockets.

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Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING:

A Kits and modules
B Tools
C PC boards and supplies
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E IC chips and semiconductors
F Test and measuring instruments
G Reference books

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SLR CAMERA

Brand new Russian Zenit SLR camera fitted with a 58mm-f2 screw mount lens. Fully manual, professional camera, has all necessary adjustments and also a built-in light meter. Supplied in an attractive soft carry bag: **$80**

COMPONENTS

HIGH VOLTAGE DISC CERAMICS 680pF/3kV **20 for $4,** 15nF/3kV **$2,** 1nF/15kV **$4**

SUPERCAPS 0.047F 5.5V **5 for $2**

HIGH VOLTAGE DIODES high speed 1kV/1A **10 for $5**, 8kV/20mA **$1.50**, 16kV/20mA **$2**

TRIACS 600V/60A *CLEARANCE* **$3**

CASED TRANSFORMER 230: 1.7V 300mA AC - in small plastic case with 2m input and output leads: **$6**

HIGH INTENSITY RED LEDS 550 - 1000mCd @ 20mA, 100mA max, 5mm: **10 for $4 or 100 for $30**

BLUE LEDs 5mm **$2.50**

ELECTRET MIC INSERTS High output omnidirectional standard size **10 for $8** also some high quality unidirectional electrets removed from new equipment **$3**

DYNAMIC MIC INSERTS unidirectional low impedance **$4**

EPROMS: 27C512, 512K (64K x 8), 150ns access CMOS EPROMs. Removed from new equipment, need erasing, guaranteed, **$4.**

ULTRASONIC TRANSDUCERS High quality Murata 40kHz TX and Rx transducers **$4** 40kHz crystal **$2**

3.58MHz CRYSTALS 10 for $6

OP27 OP AMP Super op amp! **$3**

ENCODER-DECODER ICs as used in many projects, SC 12/94, EA 3/93, 3/94 AX526/7/8 **$3.50** UHF module to suit **$15**

TOMINON HIGH POWER LENS

These 230mm (1:4.5) lens have never been used. They contain six coated glass lenses, symmetric, housed in a black aluminium case. Scale range is from 1:10 through to 1:1 to 10:1. Applications include high quality image projection at macro scales, and portrait photography in large formats. **$45**

LASERS

LASER POINTER PEN A pen style laser rated at 5mW/670nm. Brighter than most pens due to its high quality lens. Metal body with a tactile switch, operates from 2AA batteries (not included). Also suitable for medical uses. **$75**

AIR-COOLED ARGONS Used 30-100mW argon-ion head blue/green output. Includes details of power supply and other information: head only: **$350** *LIMITED SUPPLY*

HE-NE LASER red laser tube plus 12V universal laser power supply kit at ridiculous prices. Used 3mW tube and 12V supply kit **$65.** 6mW tube and supply kit **$170**

VISIBLE LASER DIODE KIT 5mW 670nm visible laser diode and collimating lens, with housing and APC driver kit EA 9/94 SPECIAL **$40** Same kit with 3mW/650nm laser **$65**

MOTORS

STEPPER MOTORS 6V 6 wire 1.8 deg, used **$4**

POLYGON SCANNERS: Precision motor with 8-sided mirror, plus a matching PCB driver assembly. Will deflect a laser beam and generate a line. Needs a clock pulse and DC supply to operate, information supplied. SPECIAL REDUCED CLEARANCE PRICE **$15**

MORE ITEMS & KITS

Poll our **(02) 579 3955 or (02) 579 4985** fax numbers to find out how to get our item and kit lists. MANY MANY MORE ITEMS AND KITS THAN THOSE LISTED HERE! *Ask for these lists to be sent with your next order.*

KITS

PROTECT ANYTHING ALARM KIT EA May 93, PCB and all on-board components *ON SPECIAL* **$20**

SINGLE CHANNEL UHF REMOTE CONTROL SC Dec. 92, one Tx and Rx: **$45**, extra Tx **$15.**

4-CHANNEL UHF REMOTE CONTROL KIT: Two Tx & 1 Rx **$96**.

LOW COST 1-2 CHANNEL UHF REMOTE CONTROL compact keyring transmitter kit, 1/2 million codes, receiver has 2A relay contact output, PCB and all components kit. 1 channel Tx kit **$10**, 2 channel Tx kit **$16** Rx kit **$20** extra components for 2 channel Rx operation (extra decoder IC and relay) **$6**

MASTHEAD AMPLIFIER KIT: Two PCBs plus all on-board components: Low noise (uses MAR-6 IC), covers VHF-UHF, **$18**

LASER BEAM COMMUNICATOR KIT: Tx, Rx, plus IR laser: **$60**

FM TRANSMITTER KIT - MK1 This complete transmitter kit (miniature microphone included) is the size of an AA battery, and is powered by a single AA battery. Use a two AA battery holder (provided) as the case, and a battery clip (shorted) for the switch. Battery life is over 500 hours!! **$11**

PLASMA BALL KIT: PCB and components kit, needs any 240V light bulb *ON SPECIAL* **$20.**

BRAKE LIGHT INDICATOR KIT: 60 LEDs, two PCBs and ten resistors, makes a very bright 600mm long, high intensity red display **$25.**

GARAGE DOOR - GATE REMOTE CONTROL KIT: SC 4/94 Tx **$18**, Rx **$79.**

1.5-9V CONVERTER KIT: $6 ea. or 3 for **$15.**

12V-2.5W SOLAR PANEL

These US made amorphous glass solar panels only need terminating and weather proofing. We provide clips and backing glass. Very easy to complete. Dimensions: 305x228mm, Voc: 18-20V, Isc: 250mA. SPECIAL REDUCED PRICE! **$20 ea. or 4 for $60.** A very efficient switching regulator kit is also available: Suits 12-24V batteries, 0.1-16A panels, **$27.** Also available, a simple and efficient shunt regulator kit, **$5.**

POWER SUPPLIES

EHT POWER SUPPLY; Out of new laser printers, deliver –600V, 7.5kV and +7kV when powered from a 24V-800mA DC supply, enclosed in a plastic case, **$16.**

COMPUTER POWER SUPPLIES, Used, clean non-standard mains input, +5V @ 8A, +12V @ 3A, and -12V @ 0.25A DC outputs. BARGAIN: **$18 ea. or 4 for $60**

12V 8A DC SUPPLY FOR $8 by using two of the above, information supplied.

CCD CAMERA

Very small PCB CCD camera with auto iris lens, 0.1lux 320k pixels, IR responsive, has 6 IR LEDs on PCB, almost matchbox size! **$199**

We may be able to supply a used 12V green monitor and conversion kit for an extra **$35** See SC June 95

PROJECTION LENS

Brand new, precision angled projection lens. Overall size 210x136mm. High-impact Lexan housing with focal length adjustment. When disassembled yields three 4" diameter lenses (concave, convex-concave, convex-convex). Very limited quantity. **$35**

2mA ELECTRIC FENCE

This extremely efficient design is almost identical to that published recently in SC. The main difference is that our PCB is much smaller: The kit includes a PCB and *ALL ON - BOARD COMPONENTS, USED 12V IGNITION COIL,* and even the parts for a high voltage *CAPACITIVE VOLTAGE DIVIDER PROBE* that flashes a neon lamp for voltages exceeding 2kV. **$25**

IR COMPONENTS

IR LEDs 880nm 12º 30mW @ 100mA **10 for $9** 60º types **10 for $9**, 940nm 12º 16mW @ 100mA **10 for $5**

IR DETECTOR PIN DIODE 10 for $10

IR LASER DIODES 5mW/780nm **$16** 40mW/830nm **$60**

DRIVER KIT, LENS & HOUSING to suit the above IR laser diodes **$14**

OPTICS

USSR LENS 100mm/f2 Pentax screw mount, for night viewers, has focus adj, but no iris adj **$60**

USSR LENS 58mm/f2 Pentax screw mount, used for cameras, has focus and iris adj **$60**

PRECISION FRONT SURFACE ALUMINIUM MIRRORS 200 x 15 x 3mm **$3** 50 x 72 x 3mm **$3**

PORRO 90deg PRISM makes a rainbow from white light **$10**

NIGHT VIEWERS

New 1st gen image intensifier tubes plus supply kit **$120.** Used 2nd gen image intensifier tubes **$400 to $600**

SMALL PASSIVE NIGHT VIEWER KIT Supplied with new and completely assembled USSR made scope from a binocular helmet-mounted passive viewer. EHT supply kit. Scope works in extremely low light. *Best value small night vision scope* **$290**

3-STAGE STARLIGHT TUBES Fibre optically-coupled, minor blemish, with EHT supply kit, lens, eyepiece **$250**

MISCELLANEOUS

PELTIER DEVICES Solid state, can be used to make a thermoelectric cooler - heater. Basic information included. 12V-3.4A $25 12V-4.5A **$35**

We can also provide two thermal cut-out switches and a 12V DC fan to suit either device **$10**

LCD CHARACTER DISPLAYS standard 16 x 1 display, 5V **$20**

IEC EXTENSION LEADS: 2m, with IEC plug and IEC socket **$5.**

3" CONE TWEETERS Sealed back dynamic 8 ohm tweeters: **$5**

WELLER SOLDERING IRON TIPS New soldering iron tips for low voltage Weller soldering stations and mains operated Weller irons. Mixed popular sizes and temperatures. Specify mains or soldering station type: **5 for $10.**

LIGHT MOTION DETECTORS Small PCB assembly based on a ULN2232 IC. Can detect humans crossing a narrow corridor at up to 3 metres **$5**

MINI PHONO

This brand new unit was designed to play small records which are no longer available. The compact self-contained unit (140x83x57mm) is housed in a plastic case and includes a motor, speaker and amplifier. Great for a simple workbench audio amplifier that is powered from two AA batteries (not included). **$8**

HALL EFFECT SWITCH

Solid state switch that reacts to the proximity of magnetic fields. Runs at extremely high speeds, up to 100kHz. Operates from 4.5 to 24V DC supply with 10mA sink-type digital output. Supplied with a suitable magnet. **$2 ea. or five for $8**

HALOGEN TRANSFORMER

Compact (41x66x30mm) metal cased electronic transformers, 95% eff, 25kHz. Mains powered, can power up to 50W halogen or incandescent lamps. Not approved, but good for components, experimenting **$10 ea. or 4 for $30.**

OATLEY ELECTRONICS

PO Box 89, Oatley NSW 2223

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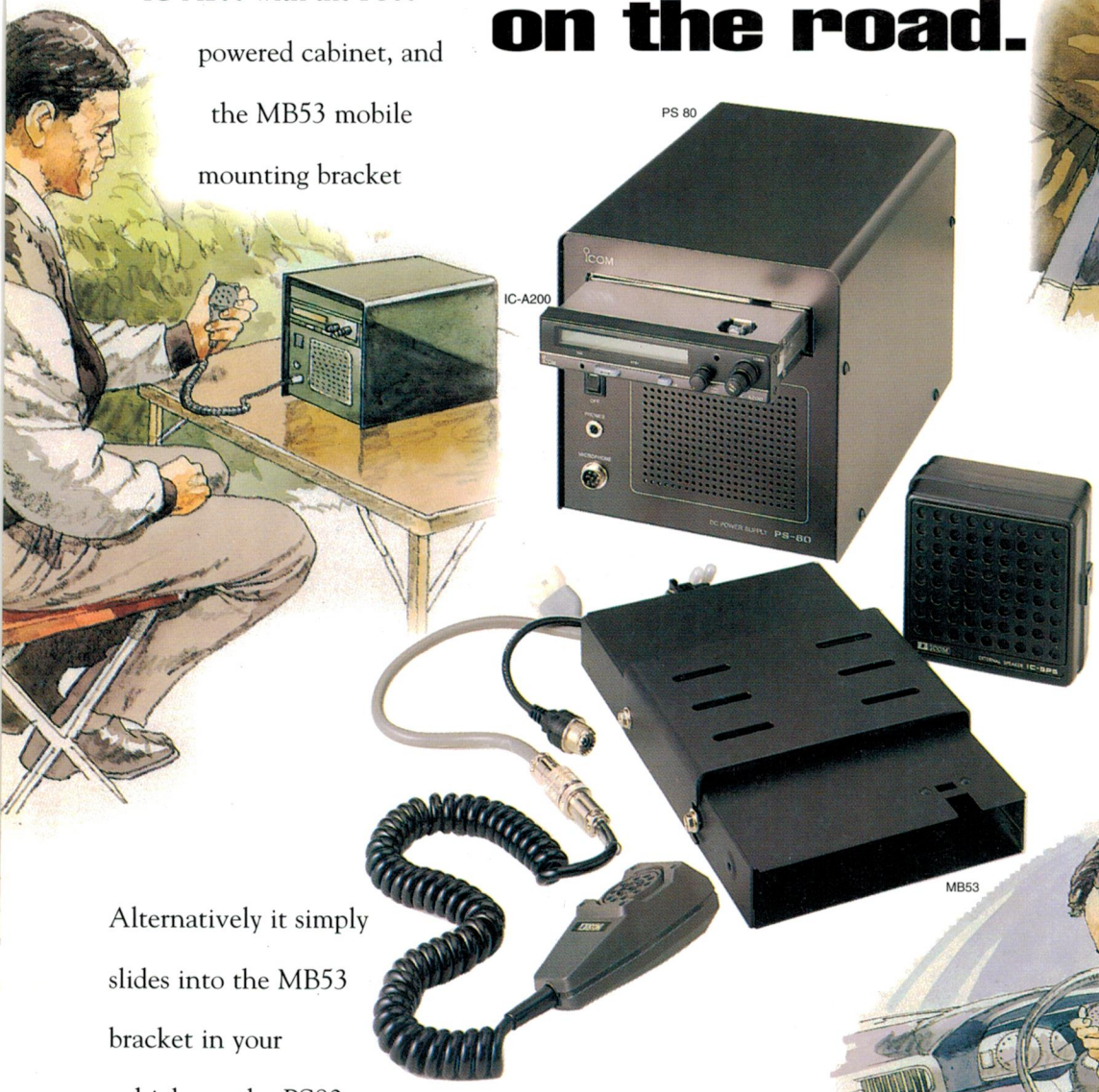
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The IC-A200 VHF air band transceiver offers you amazing 3 way communications versatility. When you combine the IC-A200 with the PS80 powered cabinet, and the MB53 mobile mounting bracket you have remarkable flexibility for a wide variety of aviation communication uses. The unit can be panel mounted in your aircraft for VFR use.

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Alternatively it simply slides into the MB53 bracket in your vehicle, or the PS80 cabinet wherever you need to use it. To get the full 3 way communications versatility story talk to the avionics experts at Icom or your nearest Icom dealer.



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